CARLETON
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Faculty of Graduate Studies and Research

The Calendar is published several months in advance of the beginning of the academic year. The University reserves the right to make whatever changes may be required, including alteration of the various fee schedules and cancellation of particular courses.

Office of the Dean

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Associate Dean (Student and Academic Services)
K.J. McGillivray

Assistant Dean (Systems and Information
Development)
Roy Gibbons

Office Hours

September 1 to April 30
9:00 A.M. to 12:00 noon
1:00 P.M. to 5:00 P.M.

May 1 to August 31
8:30 A.M. to 12:00 noon
1:00 P.M. to 4:30 P.M.

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Carleton University is a community of faculty, staff and students who are engaged in teaching, learning and research. Its members are part of the community at large and are governed by the law common to all persons. But membership in the academic community also entails certain rights and responsibilities. The University respects the rights of speech, assembly, and dissent; it prohibits discrimination on the basis of race, ancestry, place of origin, colour, ethnic origin, national origin, creed, sex, age, marital status, family status, political affiliation or belief, sexual orientation, or any handicap that is defined as such in the Human Rights Code of Ontario; it requires tolerance and respect for the rights of others; and it promotes an environment conducive to personal and intellectual growth.

(Please prefer to Offences of Conduct, General Regulations, Section 15, page 28.)

Educational Equity Policy

Preamble

In support of Carleton University's commitment to Section 15 of the Federal Charter of Rights and Freedoms, Sections 4 and 13 of the Ontario Human Rights Code, and the University's mission statement,

Statement of Principles

Carleton University is committed to providing equity in its educational programs and services and a welcoming environment for all individuals regardless of race, creed, colour, age, sex, sexual orientation, marital status, family status, ancestry, ethnic origin, place of origin, or disability, as defined in the Ontario Human Rights Code.

Carleton University strives for the best possible educational experience for all of its students. The University attempts, to the best of its ability, to encourage and assist all students to succeed academically and as members of the University community.

Educational Equity Policy Statement

In support of its commitment to excellence in teaching, scholarship and research Carleton University seeks to identify University policies, programs and services that need to be changed, enhanced or created, subject to the availability of resources, in order to:

(a)   increase the access, retention and graduation of groups of students who have traditionally been under-represented, under-served and/or disadvantaged in University programs, and

(b)   provide a supportive and welcoming learning environment for all students.

The designated groups for educational equity include, but are not limited to: women; Aboriginal peoples; persons with disabilities; racial, ethnic or visible minorities; the economically disadvantaged; mature and part-time students; gay men, lesbians and bisexuals; and international students.

The University undertakes to provide reasonable accommodation to these groups and, to the extent that it is possible, to implement special measures to support the achievement of the University's education equity goals.

In support of its commitment to achieve and maintain a hospitable campus climate for all students, faculty, and staff, the University undertakes to provide education and training on human rights issues as these relate, *inter alia*, to curriculum and pedagogy.

The University

Carleton University is a contemporary, enterprising university situated in Canada's capital. Undergraduate and graduate programs are offered in the disciplines of arts, social sciences, engineering and science and through many professional schools and institutes. Specialized research is carried out in more than 82 organized research centres. With some 22,415 full-time and part-time students from the national capital region, from across the country, and from more than 90 countries around the world, Carleton has acquired a reputation that is world-wide.

Founded in 1942 as a non-denominational, private, co-educational college, Carleton initially occupied a few rented classrooms in church basements and high schools in downtown Ottawa. Full-time programs were offered in 1946 in journalism and public administration. Rapid expansion during the following years led to the development of a new campus on a large and picturesque site between the Rideau River and the historic Rideau Canal.

Carleton's location in Canada's capital has shaped its philosophy and character in a special way. Throughout its fifty-year history, Carleton has explored the Canadian perspective in many fields and utilized Ottawa's unique resources to give its students an advantage that few other universities enjoy. In the pursuit of academic excellence, Carleton has played a national role in contributing to the quality of public discourse in Canada and to the advancement of our country's international relations. Looking to the future, the University is at the forefront in developing new partnerships, new programs, and new directions in teaching and research that will enable its graduates to lead in meeting the challenges of tomorrow. Forging ties with business, industry, government, and other educational institutions will ensure the most relevant education and most current research that is leading-edge.

The first undergraduate degrees, awarded in 1946, were in journalism and in public administration and the first graduate diploma in 1954 was in public administration. Today, the University offers graduate instruction leading to the master's degree in some 38 fields and to the doctorate in 16 fields. In 1993-94, The Faculty of Graduate Studies and Research registered some 2,568 students in full-time and part-time studies.

Carleton has set as its major goal in graduate studies the promotion of the spirit of independent investigation and the pursuit of scholarly work of consistent high quality. By concentrating on certain fields of study and by electing areas in which it had a comparative advantage, the University has been able to ensure great success in the pursuit of these goals. With outstanding scholars, challenging and imaginative programs, excellent students, libraries, laboratories, and other resources and facilities, the University can provide its students with the most current and relevant education. Graduate programs in science and engineering are enhanced by linking resources and expertise with the University of Ottawa to create institutes that are among the finest in the country. Moreover, students in all programs have access to the vast number of scholars working in government organizations and to the special facilities associated with these national and international institutions.

Carleton University's 27 buildings occupy a beautiful 62-hectare campus just 10 minutes drive south of Parliament Hill. A special feature of the campus is an extensive underground tunnel system which makes the University especially accessible for students who have mobility impairments. The MacOdrum Library houses more than a million volumes and an extensive collection of microfilms, archival material, maps, documents and prints all accessed by an on-line catalogue system with terminals on every floor. Reading rooms and special interest resource centres are maintained by many departments on campus. Accommodations for more than 1,666 students is provided in Carleton's six residence buildings and cafeterias throughout the campus offer meals and snacks. The physical recreation centre houses facilities for a wide range of activities from individual fitness to interuniversity team competition in a number of sports. Special-interest clubs, public lectures, concerts, films, live theatre, conferences and conventions bring many dimensions to campus life.

Recreational, cultural, and leisure-time activities to suit every taste abound in the national capital area. The National Arts Centre, the Museum of Civilization, the National Art Gallery enlighten and entertain in both English and French. Carleton boasts the world's longest winter skating rink, the Rideau Canada, at its doorstep and miles of bike paths and walking trails surround the picturesque campus along waterways and greenbelts.

Effective July 1, 1992, all academic and administrative buildings became smoke-free.

Smoking is allowed only in the smoking sections of the cafeterias and pubs in the University Centre and Commons buildings and residences.

Degree Programs

The following graduate programs are currently offered at Carleton:

Graduate Diploma in Public Administration (D.P.A.)

Master of Arts (M.A.)
Anthropology, Applied Language Studies, Canadian Art History, Canadian Studies, Central/East European and Russian-Area Studies, Communication, Comparative Literature, Economics, English, French, Geography, German, History, International Affairs, Legal Studies, Philosophy, Political Economy, Political Science, Psychology, Public Administration, Religion, Spanish, and Sociology

Master of Computer Science (M.C.S.)

Master of Engineering (M.Eng.)
Aerospace, Civil, Electrical, Materials and Mechanical Engineering

Master of Journalism (M.J.)

Master of Management Studies (M.M.S.)

Master of Science (M.Sc.)
Biology, Chemistry, Earth Sciences, Information and Systems Science, Mathematics, and Physics

Master of Social Work (M.S.W.)

Doctor of Philosophy (Ph.D.)
Biology, Chemistry, Computer Science, Earth Sciences, Economics, Engineering (Aerospace, Civil, Electrical, and Mechanical), History, Mathematics, Physics, Political Science, Psychology, Public Policy and Sociology

Joint programs with the University of Ottawa are offered in the following areas: Civil Engineering, Electrical Engineering, Mechanical and Aerospace Engineering, Biology, Chemistry, Computer Science, Earth Sciences, Mathematics and Statistics, Physics, and Economics.

The Department of Psychology offers a joint Specialization in Neuroscience. The Departments of Biology, Chemistry and Psychology offer a collaborative program in Chemical and Environmental Toxicology.

Academic Dress

The academic dress of Carleton University is a compromise between the style of hoods outlined in the American Intercollegiate Code and the dress of ancient foundations of Britain and America.

The master's hood, made of black silk, is of simple or Oxford shape with an open lining of two chevrons (red and black) on a silver field. The border of the hood denotes the degree granted, according to the following colour combinations: arts — white; journalism — white with a black cord sewn slightly in from the lower border; management studies — camel brown with a black cord sewn slightly in from the lower border; science — golden yellow; computer science — royal blue; social work — cream; engineering — orange. The master's gown is of full style, made of black silk or rayon, with full gathered yoke behind and closed sleeves with an opening at the elbows.

The Doctor of Philosophy hood is also made of silk, but completely opened to show the lining, and provided with a purple border. The doctoral gown has the same style as the master's and is made of royal blue cloth with facings of light blue silk.

The gown of the Honorary Doctorate of Laws, of Literature, of Science, or of Engineering is a blue robe with bell-shaped sleeves, made of fine royal blue cloth with facings and sleeves in light blue silk. The hood is made of the same material as the gown, has the same lining as that for the degrees granted by examination, and is bordered with purple for the degree of Doctor of Laws, vibrant blue for the degree of Doctor of Literature, dark red for the degree of Doctor of Science, and orange for the degree of Doctor of Engineering.

Academic Schedule

The following schedule of dates is anticipated for academic activities and procedures; however, it is subject to final confirmation by the University Senate.

Students in the joint programs and visiting graduate program should also check with the University of Ottawa for confirmation of their academic schedule.

Spring/Summer Term 1994

May 17
Last day to complete registration, including fee payment for first-term and full-session courses, without incurring a late registration fee.

May 18
Spring/summer-term courses begin (full-session and first-term courses).

May 23
Statutory holiday. University closed.

May 25
Last day for late registration for spring/summer term. Last day for course changes for first-term evening-division courses and for evening-division full-session courses. Students who have not yet deposited the five final copies of their thesis in the office of the Faculty of Graduate Studies and Research *must* register.

June
Spring Convocation for the conferring of degrees; dates to be announced.

June 10
Last day for withdrawal from first-term courses.

June 28
Last day for first-term evening-division courses.

June 29, 30
First-term final examinations may be scheduled.

July 1
Statutory holiday. University closed.

July 4
Second-term courses begin.

July 22
Last day for withdrawal from full-session courses, second-term courses.

August 1
Civic holiday. University closed. Evening courses missed may meet August 5.

August 12
Last day for spring/summer-term courses.

August 13, 15-17
Spring/summer-term examinations may be scheduled.

Fall Term 1994

The Faculty of Graduate Studies and Research normally admits students to commence in the fall term. However some academic units may consider applicants to commence in the winter term or the spring/summer term. Applications for admission may be submitted at any time. Applications for admission from outside Canada should be completed at least five months before the desired date of admission in order for students to make the necessary visa arrangements.

Applicants wishing to be considered for financial assistance from Carleton University are reminded that they must submit their completed applications before March 1. **Please note that some schools and departments may require completed applications prior to March 1. Students must refer to departmental entries in this calendar for details.**

August 1
Last day for submission to the thesis supervisor of six examination copies of master's and Ph.D. theses for Fall Graduation.

September 1
Last day for receipt of applications for degrees from potential graduates for Fall Graduation.

September 5
Statutory holiday. University closed.

September 6
Fall term begins.

September 6-9
Preparation week. All students are expected to be on campus from the first day of preparation week. Class and laboratory preparations, departmental introductions for students and other academic orientation activities will be held during this week. Some graduate courses in the joint programs with the University of Ottawa will begin formal classes during preparation week. Graduate students are advised to check with their department for details.

September 9
Last day to complete registration, including fee payment, for fall/winter session without incurring a late registration fee. Cancellation of course selections for those students who have not concluded fee payment arrangements.

September 9
Graduate student teaching assistantship orientation session.

September 12
Graduate fall and fall/winter classes begin.

September 23
Last day for late registration for fall term. Students who have not yet deposited the five final copies of their thesis in the office of the Faculty of Graduate Studies and Research *must* register. Last day for course changes for fall/winter and fall-term courses.

October 10
Statutory holiday. University closed.

October 11
Last day for submission to the office of the Faculty of Graduate Studies and Research of five final copies of master's and Ph.D. theses for Fall Graduation.

November
Fall Convocation for the conferring of degrees; date to be announced.

November 11
Last day for withdrawal from fall-term courses.

December 1
Last day for receiving applications for degrees from potential graduates for Winter Graduation. Last day for submission to the thesis supervisor of six examination copies of master's and Ph.D. theses for Winter Graduation.

December 5
Last day for fall-term courses.

December 6-22
Final examinations in fall courses and mid-term examinations in fall/winter courses, may be scheduled as announced. It may be necessary to schedule examinations for classes held in the evening during the day and vice versa.

Winter Term 1995

January 2
Winter-term courses begin. Last day to complete registration, including fee payment, for fall/winter session and winter-term courses, without incurring a late registration fee.

January 6
Cancellation of course selections for those students who have not concluded fee payment arrangements.

January 13
Last day for late registration for winter term. Students who have not yet deposited the five final copies of their thesis in the office of the Faculty of Graduate Studies and Research *must* register. Last day for course changes for winter-term courses.

January 27
Last day for submission to the office of the Faculty of Graduate Studies and Research of the five final copies of master's and Ph.D. theses for Winter Graduation.

February 1
Last day for receiving applications for degrees from potential graduates for Spring Convocation.

February 20-24
Winter break – courses suspended.

March 1
Last day for receipt of applications for admission from candidates who wish to be considered for the initial award (April) of financial assistance (including Carleton fellowships, scholarships, and departmental assistantships) administered by Carleton University. Candidates whose applications are received after the March 1 deadline date may be eligible for the award of a fellowship, scholarship, or assistantship by reversion. Last day for submission to the thesis supervisor of six examination copies of master's and Ph.D. theses for Spring Convocation.

March 10
Last day for withdrawal from fall/winter and winter-term courses.

March 31
Last day of courses for fall/winter and winter-term courses. Some graduate courses may continue during review week until the end of winter term on April 7.

April 3-7
Review week. Some lectures, laboratories, review tutorials, etc. may take place in review week until the end of winter term on April 7.

April 7
Winter term ends.

April 10-29
Final examinations may be scheduled as announced. It may be necessary to schedule examinations for classes held in the evening during the day and vice versa.

April 14
Statutory holiday. University closed.

May 15
Last day for submission to the office of the Faculty of Graduate Studies and Research of the five final copies of master's and Ph.D. theses for Spring Convocation.

June
Spring Convocation for conferring of degrees; date to be announced.

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Course Designation System

Prefix Numbering

Each course number is prefixed by the number or numbers of the department, institute or school under whose auspices the course is offered.

11   Art History
12   Canadian Studies
17   Comparative Literary Studies
18   English
19   Film Studies
20   French
22   German
24   History
28   Journalism and Communication
29   Linguistics
30   Music
32   Philosophy
34   Religion
38   Spanish
42   Business
43   Economics
44   Political Economy
45   Geography
46   International Affairs
47   Political Science
49   Psychology
49   Specialization in Neuroscience
50   Public Administration
51   Law
52   Social Work
53   Sociology
54   Anthropology
55   Central/East European and Russian-Area Studies
61   Biology
65   Chemistry
67   Earth Sciences
70   Mathematics and Statistics
74   Physics (*joint program*): offered at University of Ottawa
75   Physics
76   Architecture
77   Architecture
78   Architecture
82   Civil and Environmental Engineering
83   Civil Engineering (*joint program*): offered at University of Ottawa
85   Industrial Design
88   Mechanical and Aerospace Engineering
89   Mechanical and Aerospace Engineering (*joint program*): offered at University of Ottawa

92   Electrical Engineering (joint program) offered at University of Ottawa
93   Information and Systems Science
94   Systems and Computer Engineering
95   Computer Science
97   Electronics

Course Numbering Pattern

The course numbering pattern is, in general, as follows:

001-099   Courses usually taken in Qualifying University year
100-199   Courses usually taken in First year
200-299   Courses usually taken in Second year
300-399   Courses usually taken in Third year
400-499   Courses ordinarily taken in Fourth-year Engineering, Fourth-and Fifth-year Architecture, and Fourth-year (Honours) Arts, Social Sciences, Science and Computer Science
500-599   Courses ordinarily taken by graduate students
600-699   Courses ordinarily taken by graduate students

General Regulations

1. Administration of the Regulations

1.1 General Administration
The regulations on the following pages apply to all degree and diploma programs administered by the Faculty of Graduate Studies and Research.

1.2 Student Responsibility
(a) The student is responsible for knowing the regulations of the Faculty of Graduate Studies and Research and for complying with them. Any exceptions to the regulations must be approved, in writing, by the Dean of the Faculty of Graduate Studies and Research. Routine approval of a records form does not constitute approval of an exception.

It is also each student's responsibility to establish and maintain contact with his or her faculty adviser or thesis supervisor.

(b) In order for a student to receive his or her degree, he or she must fulfil:
1. all the requirements of the department, school or institute in which he or she is taking the degree;
2. all faculty regulations;
3. all University regulations;
4. all financial obligations to the University.

2. Admission Requirements and Eligibility

2.1 General Requirements
Graduates of recognized universities will be considered for admission to the Faculty of Graduate Studies and Research. The University's general policy on admission is outlined below, but all applicants should refer to the departmental statements in this calendar for details concerning the specific or additional requirements of each department, institute or school.

2.2 Eligibility
A combination of factors is taken into consideration in assessing the eligibility of a candidate for admission into one of the graduate programs:
(a) the performance of the candidate and the assessment provided by his/her referees as a measure of the likelihood that the candidate can successfully complete the course of studies and research defined by the Senate of the University for the given degree
(b) the capacity of the graduate department, institute, or school to provide a program of studies and research which would meet the expectations of the candidate as defined in his/her statement of academic interests and ambitions

(c) the availability of a faculty member competent to supervise the academic program of studies and research of the candidate at the time.

2.3 Qualifying-Year Program
Applicants who do not qualify for direct admission to the master's program may be admitted to a qualifying-year program. Applicants who lack an honours degree, but have a pass degree with honours standing (a least B overall) will normally be admitted to a qualifying-year program.

If successful in this qualifying year and upon formal application to the Faculty of Graduate Studies and Research, the student may eventually proceed to the master's program. However, admission to the qualifying-year program does not imply automatic admission to the master's program. At the end of the qualifying-year program the student will be required to apply for entry into the master's program at which time the department will determine the student's eligibility to enter the program. If successful, the student will be informed of this decision by the Dean of the Faculty of Graduate Studies and Research.

Applicants for a master's degree who have a program requirement of seven and one-half full courses or more (with the exception of Social Work, Public Administration and Journalism) will register initially in the qualifying-year program.

Courses taken to fulfil the requirements of the qualifying-year program may not be used for credit for the master's degree. Courses taken extra to the program requirements of the qualifying year and which have been successfully completed, may be considered for credit towards the master's degree.

2.4 Master's Program
For admission to the master's program, applicants must hold an honours bachelor's degree, or the equivalent, with at least high honours standing (normally B+ or better in honours subject; B− or better overall). The applicant must also be recommended by the department in which he/she plans to undertake his/her studies.

Applicants for a master's degree who have a program requirement for seven full courses or less will register directly in the master's program.

2.5 Doctoral Program
For admission to the Ph.D. program, applicants must ordinarily hold a master's degree (or equivalent) from a recognized university, normally with a minimum average of B+ in courses (including thesis where applicable), and normally with no grade below B−.

2.6 Restriction on Degrees

Applicants should note that of the bachelor's, master's, and Ph.D. degrees, only two may ordinarily be taken at Carleton University.

3. Application for Admission

3.1 Senate Policy Statement on Accessibility for the Disabled

Carleton University is committed to making reasonable accommodation to individuals with disabilities and actively encourages application from disabled students. This commitment includes gaining an understanding of the circumstances of an individual's disabilities and to adjust services to all academically qualified individuals to compete on an equitable basis.

Our applications process assures confidentiality insofar as the admission decision is concerned while identifying the candidate to the Paul Menton Centre for Persons with Disabilities so that those who gain admission can make the decision to come to Carleton after assessing the extent to which specialized services will be available.

Academic accessibility is intrinsically linked to physical accessibility. Carleton is committed to continually monitoring and upgrading physical accessibility to whatever extent is possible.

A standing Committee of the Senate monitors the needs and problems of disabled students in conjunction with their academic problems and makes recommendations for improvements. (See General Information, Counselling and Student Life Services, Persons with Disabilities, page 33).

3.2 Application Forms

Applications for admission to the Faculty of Graduate Studies and Research should be made on prescribed forms, available from the major department or the office of the Faculty of Graduate Studies and Research, and they should be submitted directly to the department. To cover administrative costs, a non-refundable charge of $25 (Can. or U.S. funds) is required with each application.

3.3 Deadlines

The Faculty of Graduate Studies and Research normally admits students to commence in the fall term. However some academic units may consider applicants to commence in the winter term or the spring/summer term. Applications for admission may be submitted at any time. Applications for admission from outside Canada should be completed at least five months before the desired date or admission in order for students to make the necessary visa arrangements.

Applicants wishing to be considered for financial assistance from Carleton University are reminded that they must submit their completed applications before March 1. **Please note that some schools and departments may require completed applications prior to March 1. Students should refer to departmental entries in this calendar for details.**

Students applying to joint programs with the University of Ottawa should note that application procedures, especially deadlines, are different in the two institutions, and they should refer to the university calendars for details.

3.4 Transcripts

Two detailed *official* transcripts of the applicant's entire university record must be sent to the chair of the department concerned.

3.5 Letters of Reference

All applications must be supported by letters of recommendation from at least two faculty members with whom the candidate has studied, who are in a position to assess his/her potential for graduate studies and research. References from non-academic supervisors are not ordinarily acceptable, except in certain cases, such as that of an applicant working in a research laboratory environment. All letters of reference are to be sent by the referees directly to the chair of the department.

3.6 Proficiency in English

Proficiency in English is necessary to pursue graduate studies at Carleton University. All applicants whose native tongue is not English must be tested for proficiency in the English language. This requirement may be satisfied by presenting a TOEFL score of at least 550, (TOEFL tests are administered by TOEFL, Box 899, Princeton N.J. 08540, U.S.A.), or by achieving scores of 70-90 in three of the four skill areas on the Carleton Assessment of English administered by the Centre for Applied Language Studies, Room 215, Paterson Hall, Carleton University.

4. Admissions Procedure

4.1 General Procedure

All applicants for admission will initially be examined and evaluated by the department, institute or school in which the applicant wishes to study. All supporting documents (transcripts, letters of reference, etc.) must be received before any application can receive formal consideration. Completed applications of those students whom the department wishes to recommend for admission will be forwarded to the Dean of the Faculty of Graduate Studies and Research for consideration.

The office of the Dean will officially notify each applicant whose admission is approved.

4.2 Admission Validity for New Students

The Statement of Standing on Admission issued to each newly-admitted student is valid only for the twelve month period stipulated on the form. If the applicant fails to register within this period of time, his/her admission and registration eligibility will lapse automatically. He/she may re-apply for admission.

4.3 Revocation of Admission or Registration

The University may nullify an admission and revoke a registration if it finds that an applicant for admission or registration has in the process provided false or incomplete information.

5.   Program Requirements

5.1   General Information

A description of each program offered under the auspices of the Faculty of Graduate Studies and Research is presented in the departmental program descriptions and details of courses section of this calendar. Prospective applicants should note particularly the admission requirements, the fields in which advanced study and research may be undertaken, and the program requirements of each department, in addition to the general regulations of Faculty of Graduate Studies and Research, which are spelled out in this section.

5.2   Qualifying-Year Program

Students in the qualifying year will ordinarily register in five full courses (or the equivalent) at the senior undergraduate level. Of these five, normally no more than one course at the 200 level and no more than two at the 500 level may be taken.

5.3   Master's Program

The normal requirement for the master's degree is five full courses, or the equivalent, of which at least four (including the thesis where applicable) must be at the 500 level. With departmental approval, the remaining one course may be selected from those offered at the senior undergraduate level, that is at the 400 level.

Where applicable the normal requirement for a ten-course master's degree is ten full courses, or the equivalent, of which at least eight (including the thesis where applicable) must be at the 500 level. With departmental approval, the remaining two full courses may be selected from those offered at the senior undergraduate level, that is, at the 400 level.

5.4   Doctoral Program

The period of formal study and research required in the Ph.D. program will normally be at least two years of full-time study (or the equivalent) beyond the master's level.

The thesis will ordinarily carry a weight of about half of the total requirement of ten full courses or equivalent.

Ordinarily, all courses taken for credit towards the Ph.D. degree must be at the 500 or 600 level.

5.5   Language Requirements

Some graduate programs require a reading knowledge of one or more languages other than English. Language requirements will be prescribed by departments according to their regulations and the needs of their students. Language requirements must be completed within the time limit allowed for the completion of the student's program.

6.   Transfer of Credit

6.1   Transfer of Credit on Admission

Graduate courses completed at another institution or at Carleton University may be accepted in partial fulfilment of Carleton's degree requirements. Credit for such work will be determined in each case by the Faculty of Graduate Studies and Research, on the recommendation of the department concerned. Master's candidates in a five-course program are allowed a maximum of two transferred full-course credits. In addition, if a master's candidate is granted transfer of credit for two full courses, his/her remaining three courses at Carleton must be at the 500 level.

Master's candidates in a ten-course program are allowed a maximum of four transferred full-course credits. In addition, if a master's candidate is granted transfer of credit for four full courses, his/her remaining six courses at Carleton must be at the 500 level.

Doctoral candidates may be given up to one year's credit for work completed at other universities, but must normally register for a minimum of one year of full-time studies thereafter at Carleton, and fulfil the thesis and comprehensive examination requirements. Students admitted with transfer of credits in a Ph.D. program may be required to pass a qualifying examination upon entry.

A candidate who has completed courses as a special student is not normally permitted to transfer such courses for degree credit in the Faculty of Graduate Studies and Research.

Special students enrolled in a graduate level course are subject to Special Student regulations outlined in the undergraduate calendar.

6.2 Transfer of Credit After Admission

A student formally admitted, and eligible to register in a graduate program, is not permitted to register at Carleton University at the same time in any other graduate program or as an undergraduate or special student. Should he/she do so, credits may not be transferred.

Similarly if a student normally admitted to a graduate program at Carleton wishes to enrol in courses at another university, credit will be granted only if written permission is received from the Dean of the Faculty of Graduate Studies and Research. Such permission must be received in advance of registration for the course work. *In no case will such transfer alter the maximum number of allowable transferred credits noted above.*

7. Registration and Course Selection

7.1 The Calendar Year

The Faculty of Graduate Studies and Research divides the calendar year into three terms, and the academic year (September-May) into two terms; each term comprises about thirteen weeks of lectures or seminars. The first term of the academic year is designated as the *fall term* (registration period at the beginning of September); the second term of the academic year is designated as the *winter term* (registration period early in January), and the third term of the calendar year is designated as the *spring/summer term* (registration period in late May). The precise dates of registration for the fall, winter, and spring/summer terms are specified in the academic schedule of this calendar.

7.2 Course/Program Approval

Graduate students must have approval from their departmental supervisor of graduate studies for initial course/program registration, and for any subsequent course changes. This approval is also required for any undergraduate student who wishes to register in a graduate-level course.

Credit will be granted only for those courses and research activities for which the candidate is formally registered. An unregistered student is not entitled to attend lectures, tutorials, or seminars, and is not entitled to thesis supervision, examinations privileges, or access to research facilities. A student will receive no credit for any work completed during a term in which he/she was not properly registered.

7.3 Student Records Information
Names

As the University is committed to the integrity of its student records, each student is required to provide on the application for admission their complete, legal name. Any requests to change a name, by means of alteration, deletion, substitution or addition, must be accompanied by appropriate supporting documentation. Upon making application for graduation students may be asked to provide proof of their name.
Addresses

Incorrect address information will delay the receipt of awards, information and examination results. Students must notify the office of the Faculty of Graduate Studies and Research immediately of any change in:
(a) permanent or home address (used for final grades and registration information)
(b) local address (used for all mail during the academic session)
(c) telephone number for permanent address and for local address

7.4 Revocation of Registration/Admission

The University may nullify an admission and revoke a registration if it finds that an applicant for admission or registration has in the process provided false or incomplete information.

7.5 Course Selection

A student proceeding to a graduate degree or diploma must arrange his/her program according to the regulations of the Faculty of Graduate Studies and Research and the major department.

The course and thesis requirements of each graduate program are organized or defined in units of full-course credits. A full-course credit typically comprises three hours of lectures or seminars a week for two terms, or the equivalent. A half-course credit typically comprises three hours of lectures or seminars a week for one term, or the equivalent.

7.6 Evaluation

To gain standing in a course, a student must meet the course requirements for attendance, term work, and examinations.

Instructors will inform their classes by distributing written notices before the last day for late registration of the elements that will contribute to the final grade and their weighting, including attendance, class participation, essays, tests, laboratories, or studio-workshops, or other course-related work assignments, and final examinations.

Supplemental or other grade-raising examinations are not permitted for students registered in the Faculty of Graduate Studies and Research.

7.7 Tutorials

These are arranged to allow students to take full advantage of all the resources of the University, even in areas or fields of a very highly specialized

nature. Such arrangements are subject to the approval of the supervisor of graduate studies, who will arrange that a document spelling out the details of the topic, reading list, etc., is submitted to the office of the Faculty of Graduate Studies and Research before the last day for course changes in the term concerned.

7.8   Audit Courses
Graduate students may register to audit *one full course per program.*
(a)   Full-time students will not be charged an additional fee; others must pay the prevailing fee for part-time students.
(b)   Part-time students will not be permitted to audit a course in addition to two half courses for credit per term.

7.9   Course Numbering System
Each course is identified by a seven-symbol code. The first two digits indicate the department, school, or committee under whose auspices the course is offered. The three digits following the decimal point identify the specific course. The letter which follows the course number designates the term in which the course is offered, for example: F: fall term, W: winter term; S: spring/summer term, and T: two terms (fall and winter). The number which follows the letter indicates the credit weight of the course: 1 denotes one half-credit course, 2 denotes one full-credit course, etc.

7.10   Full-Time Course Load
A full-time graduate student will normally register in a minimum of three half courses (or the equivalent) per term. An audit is not permitted as part of the three half-courses required per term to maintain full-time status.

7.11   Part-Time Course Load
Part-time students are permitted to enrol in a maximum of two half courses per term including audit courses.

7.12   Status
All students are reminded that status is established only by formal registration in the appropriate courses for each term of activity in the calendar year.

Those students registering solely in a thesis, research essay, or independent research project will declare whether their status is full-time or part-time according to the definition in 7.13 and 7.14.

7.13   Definition of Full-Time Status
In addition to the *course load* requirements described above, the following criteria for full-time status have been established by the Ministry of Education and Training:
(a)   Students must identify themselves as full-time students; that is, they are studying full-time on their degree requirements and must register full-time during each term of activity.

Students who are unsure of what status to declare at the time of registration (either full- or part-time) should contact the office of the Faculty of Graduate Studies and Research for assistance, at 788-2525.

7.14   Definition of Part-Time Status
In addition to the course load restriction described above (see item 7.11), part-time status in thesis, research essay and independent research project is normally only permitted when a graduate student is employed in work not directly related to his/her program for more than an average of ten hours per week.

Students who are unsure of what to declare at the time of registration (either full or part-time) should contact the office of the Faculty of Graduate Studies and Research for assistance, at 788-2525.

7.15   Off-Campus Research
In the interest of enriching their learning experience, graduate students may arrange to undertake full-time studies or research at another institution, or in the field. It should be understood that such activity would apply to only a part of the total program, and that the off-campus period would not normally exceed twelve months.

Requests for permission to undertake full-time off-campus study or research must be submitted, well in advance, to the Dean of the Faculty of Graduate Studies and Research, through the department concerned. Such requests should include the following information:
(a)   a detailed statement of the research proposal or program of studies, and the specific arrangements that are proposed for the supervision and direction of the work
(b)   an explanation of the reasons why the work cannot be satisfactorily undertaken while on campus at Carleton University
(c)   a description of the studies and/or research facilities that are available at the proposed off-campus location
(d)   a written statement from a responsible official (for example, the on-site supervisor or director) of the outside institution, confirming that the proposed arrangements are satisfactory, and that the candidate will be able to undertake research or studies
(e)   a time schedule for the proposed studies or research work
(f)   a statement of the candidate's expected sources of financial support

7.16 Inter-University Cooperation in Graduate Instruction

Under certain circumstances, it is permissible for a student admitted to a graduate degree program, and registered at one Ontario university, to follow an approved credit course at another university. All interested students should consult the chair of their department, prior to registration, in order to obtain further information on procedures and conditions of eligibility. In order for this procedure to be valid, students must be officially registered at their home institution by contacting the office of the Faculty of Graduate Studies and Research.

7.17 University of Ottawa

Carleton University and the University of Ottawa have developed a number of joint programs at the graduate level. The details of these are given under the appropriate academic unit later in this calendar.

Where formal joint programs do not exist, a graduate student may be permitted to follow *up to two full courses* at the University of Ottawa. Moreover, there are reciprocal arrangements worked out among departments, institutes, and schools at both universities to involve students, when it is desirable, in parts of the program of research and studies at the other institution. All interested students should consult the chair of their department, institute, or school, prior to registration, in order to obtain further information on particular departmental conditions of eligibility and procedures. In order for this procedure to be valid, students must be officially registered at their home institution by contacting the office of the Faculty of Graduate Studies and Research.

8.   Continuous Registration

8.1   Loss of Status

Any candidate who remains unregistered in his/her degree program for three terms (twelve months) will lose his/her graduate status.

8.2   Continuous Registration in Thesis, Research Essay, or Independent Research Project

Any candidate (full time or part time), after initial registration in a thesis, research essay, or independent research project, must maintain this registration in all successive terms (including the term in which the student is examined), until his/her thesis, research essay, or independent research project is completed. Completion means modifications, any retyping involved, etc. Students should note that faculty approval to register in the thesis, etc., is given on the understanding that the student will be in regular contact with his/her supervisor, and that thesis

research will be actively pursued in each term of registration.

8.3   Deposit of Thesis Copies

In the case of a thesis, registration must be maintained until five final copies are deposited in the office of the Faculty of Graduate Studies and Research. Should the final copies not be deposited in the office of the Faculty of Graduate Studies and Research by the last day for late registration in a given term, the student will be required to register for that term. A microfilming charge of $35 will be assessed at the time of deposit in the office of the Faculty of Graduate Studies and Research.

8.4   Reinstatement

Students whose files have been closed as a result of failure to observe continuous registration requirements must apply for reinstatement if they wish to continue their studies. If reinstated, students must pay a reinstatement charge which consists of $25 *plus the equivalent of two half-credit course tuition fees for each term in which they failed to register.*

The reinstatement charge is a tuition fee and therefore, is defined as eligible for income tax deduction.

8.5   Exemption from Registration

Students who have valid reasons for not registering for a term may apply for permission to remain unregistered by:

(a)   writing to the Dean of the Faculty of Graduate Studies and Research stating the reasons for seeking exemption from registration

(b)   requesting a statement from the departmental supervisor of graduate studies (and from their thesis supervisor, if there is one) in support of their request, confirming that they will not be on campus for the term, will not use any university facilities (that is, library, laboratories, computer centre, etc.), or receive any supervision, including supervision through correspondence

(c)   graduate students may apply to the Dean of the Faculty of Graduate Studies and Research through their graduate department for a one- to three-term maternity leave from the Faculty of Graduate Studies, during their program of study. While on leave students will not be registered with the faculty, nor will they be required to pay fees for this period. They will not be eligible to receive awards administered by Carleton University during the leave. In the case of other awards, the regulations of the particular granting agency will apply. The time limit for completion of program will be extended by the duration of the leave taken. Where possible, the start and finish of the leave

should coincide with the start and end of a term.

It is understood that such an exemption from registration will be granted only in exceptional cases (for example, medical or other special reasons).

Exemptions are normally granted for one term, but in extraordinary circumstances an exemption may be granted for a longer period.

When exemption from registration for a term or terms has been approved by the Dean of the Faculty of Graduate Studies and Research, this period will be exempt from the overall time limit allowed for completion of the program.

8.6   Off-Campus Registration

Students who have been permitted to study off campus, while registered full-time at Carleton, may register using Touchtone Telephone Registration or by mail.

8.7   Course Changes

A course change is the addition or deletion of one or more individual courses by a registered graduate student. This is the only acceptable procedure for revising or correcting a graduate student's registration. All course changes must be approved by the department.

Note: The deadline dates for course changes are stipulated in the academic schedule of this calendar.

8.8   Withdrawal

A graduate student wishing to terminate his/her registration in a graduate program (that is, drop all courses) must consult with the department prior to withdrawal.

(a)   Withdrawal Credit

When a student officially withdraws, a withdrawal credit will be calculated on a *pro rata* basis as of the date of withdrawal or receipt of letter. Credit for fees or refunds will depend on the date of withdrawal and the amount of fees originally paid. Students are encouraged to examine the financial implications of withdrawal. A refund schedule is available at the Business Office (see Withdrawal and Fee Credit, page 36).

(b)   Mid-Term Transfer of Program

Graduate students are cautioned that there is no procedure at Carleton University for direct "mid-term" transfer from one graduate program to another. Similarly, there can be no direct transfer to or from undergraduate or special student status. Any candidate who elects to change programs after registration (before the last day of late registration) will be required to withdraw from the first program and then register in the second. The *pro rata* refund of fees calculated as a result of withdrawal from

the first program can be applied against the new fee assessment for the second program.

(c)   Degree Completion

A registered candidate who completes his/her degree requirements by depositing the thesis/research essay prior to the last day for withdrawal in any term (as specified in the academic schedule) is required to withdraw formally if he/she anticipates any refund of fees.

Note: This only applies to thesis or research essay registration.

9.   Examinations

9.1   General Remarks

Final examinations in courses will be held at the times indicated in the academic schedule. Graduate students must obtain grades that meet the standards outlined in the academic standing section of this calendar, and that satisfy the specific requirements of the department concerned.

9.2   Supplemental and/or Grade-Raising Examinations

Supplemental or other grade-raising examinations are not permitted for students registered in the Faculty of Graduate Studies and Research. Graduate students may, however, with the permission of their department, repeat a course at the time of the next regular offering to obtain a higher standing.

9.3   Special/Deferred Final Examinations

A graduate student who is unable to write a final examination because of illness or other circumstances beyond his/her control, or whose performance on the examination has been impaired by such circumstances, may apply to write a special or deferred final examination. Such an application will be considered only if it is submitted in writing to the Dean of the Faculty of Graduate Studies and Research within *two* weeks of the examination.

If the student has been seen at the University Health Services, the office of the Dean will confirm the illness by contacting the treating physician. If the student has consulted a physician outside the University, he/she will be required to submit a statement (from the physician) confirming the illness.

In cases other than illness, appropriate documents will be required.

Students with special needs may also apply for special/deferred final examinations by contacting the Faculty of Graduate Studies and Research.

9.4 Master's Examinations and Deadlines

In addition to any examination which may be required in individual courses, a master's candidate who is writing a thesis will be expected to undertake either an oral defence of the thesis or a comprehensive examination in his field of specialization, or both. Please refer to Thesis Specifications, section 12.5, item (d) (i) Master's, for submission deadlines. When the degree is taken by course work, a comprehensive examination may be required. It is important to note that individual departments may have additional or particular requirements.

Some departments specify deadlines for the submission of thesis proposals and for comprehensive examinations. Students should check the calendar entry for their department.

9.5 Doctoral Examinations and Deadlines

Doctoral candidates may be asked to pass a qualifying examination at the beginning of their residence at Carleton University.

A comprehensive examination, covering prescribed fields, will normally be undertaken one year prior to the thesis presentation. This examination (oral or written, or both) may include any material considered fundamental to a proper comprehension of the field of study.

After the thesis has been received and accepted for examination, a final oral examination on the subject of the thesis and related fields will be held. Please refer to Thesis Specifications, section 12.5, item (d) (ii) Doctoral, for submission deadlines.

Some departments specify deadlines for the submission of thesis proposals and for comprehensive examinations. Students should check the calendar entry for their department.

9.6 Comprehensive Examinations

The date, place, and time of comprehensive examinations will be announced at least two weeks in advance. An examining board will be appointed according to the guidelines laid down by the Faculty of Graduate Studies and Research.

9.7 Unsatisfactory Grades

If the comprehensive examination is graded *Unsatisfactory*, the department may permit the candidate to repeat the examination. If the comprehensive examination is graded unsatisfactory for a second time, a request by the department that the candidate be allowed to continue in the program would require the approval of the Faculty of Graduate Studies and Research.

The comprehensive and thesis examination processes must be conducted according to the principles and practices prescribed by the Faculty of Graduate Studies and Research.

10. Grading System

10.1 Letter Grades

Carleton University employs the twelve-point system of letter grades to represent standing in graduate lecture courses, directed studies, seminars, tutorials, and some research essays and theses. The letter grades used, and the grade point equivalents, are as follows:

A+	12	B+	9
A	11	B	8
A –	10	B –	7
C+	6	D+	3
C	5	D	2
C –	4	D –	1

10.2 Other Grading Notations

Under certain defined circumstances, notations are used instead of letter grades to represent standing. The only notations permissible in the Faculty of Graduate Studies and Research are the following:

(a) a notation of *Satisfactory* or *Unsatisfactory* may be assigned, subject to the approval of the Faculty of Graduate Studies and Research, in certain very special courses involving practicum, field work, or other complex activities not easily adaptable to the twelve-point system of grading

(b) comprehensive examinations are graded *Pass With Distinction, Satisfactory,* or *Unsatisfactory*

(c) the master's thesis is graded *Pass With Distinction, Satisfactory,* or *Unsatisfactory*. The oral defence is graded *Satisfactory* or *Unsatisfactory*

(d) the Ph.D. thesis and its oral defence are each graded *Satisfactory* or *Unsatisfactory*

(e) a notation of *Incomplete* may, subject to the approval of the chair of the department, be assigned to a course in which the student has been granted the privilege of submitting an assignment after the final deadline date. This notation of *Incomplete* will be permissible only in exceptional cases (for example, medical or other special reasons), and must be replaced with a letter grade within *forty* days of the end of classes. If the notation of *Incomplete* is not changed to a letter grade (through the regular change-of-grade procedures) within *forty* days of the end of classes, the *Incomplete* notation will be changed to a grade of F, which will remain as a permanent entry on the student's

record. In exceptional cases students may petition to the Dean of the Faculty of Graduate Studies and Research to have the *Incomplete* notation remain on the student record. With the permission of the Dean of the Faculty of Graduate Studies and Research students may register to repeat the course in order to obtain a letter grade. In the circumstances that go beyond the *forty* day period (for example, medical or other special reasons) students may apply for a deferral (refer to Special/Deferred Final Examinations, Section 9.3)

(f) *Fail:* a notation of F will be assigned to any course in which the student has failed

(g) a notation of *Absent* will be assigned to any course in which the student failed to attend the final examination. If the student explains his/her absence (in writing) to the Dean of the Faculty of Graduate Studies and Research within *fourteen* days of that examination, he/she may be granted the privilege of undertaking a special or deferred examination. The notation of *Absent* will also be assigned where a student has terminated a course without formally withdrawing from the course prior to the end of classes; this notation is deemed to be the equivalent of a failure

(h) if a thesis, research essay, or independent research project is not completed by the end of the period of registration, the notation of *In Progress* will be recorded. The notation *In Progress* may, subject to the approval of the Faculty of Graduate Studies and Research, be used for a research seminar, i.e. a seminar in which students present the results of their thesis research. This notation must be replaced by an appropriate final notation or grade (as specified above) after the thesis, research essay, independent research project or research seminar has been examined. In cases where a student has registered in a research essay or a thesis, without completing it, and later undertakes course work to complete the degree program — or loses graduate student status in the program — the notation *In Progress* will remain as a permanent entry on the student's record.

10.3 Release of Grades

Grades can be accessed through the Touch Tone Telephone System for each student as soon as the grades are available after the end of the fall and winter terms of the fall/winter session and after the end of the spring session. Students may obtain a copy of their official transcript by completing a copy of the "Request for Academic Transcript" form which is available in the Faculty of Graduate Studies and

Research. Transcripts required for professional and graduate schools should be ordered well in advance of any deadline set by these institutions. Students are advised that no statement of marks or official transcripts will be released by the University until all outstanding accounts due have been paid (see Delinquent Accounts, page 36).

11. Academic Standing

11.1 Qualifying-Year Program

Students should note that admission to the master's program from qualifying year is governed by the admission requirements for the master's program outlined on page 16 of this calendar.

11.2 Master's Program

A grade of B– or better must normally be obtained in each course credited towards the master's degree. A candidate may, with the recommendation of his/her department, and the approval of the Dean of the Faculty of Graduate Studies and Research, be allowed a grade of C+ in one full course or each of two half courses. Some departments do not permit the C+ option; students should check carefully to see if the department in question has a B– minimum rule.

(a) Full-Time Continuation

Full-time master's candidates who fail to achieve a weighted grade point average of 7.0 after two terms of study, or to maintain it subsequently, will be required to withdraw from the program. In the event of special or extenuating circumstances, the student may apply to the Dean of the Faculty of Graduate Studies and Research for permission to continue in the program.

(b) Part-Time Continuation

A part-time master's student who fails to achieve or maintain a weighted grade point average of 7.0 after completing two full courses (or equivalent) will be required to withdraw from the program.

11.3 Doctoral Program

Doctoral students must normally obtain a grade of B– or better in each course credited towards the degree.

11.4 Departmental Evaluation

In addition to the above requirements, departments will undertake a periodic evaluation of a student's progress in his or her overall program of studies and research to determine whether that progress is satisfactory. In the event that progress is deemed unsatisfactory, the department may recommend to the Dean of the Faculty of Graduate Studies

and Research that the student be required to withdraw.

12.   Thesis Requirements

Note: Copies of the *Thesis Guidelines* manual are available in the departments or in the Faculty of Graduate Studies and Research office.

12.1 General Remarks

The thesis is a major requirement of most programs and, in conjunction with the research for it, makes up at least one half of the time normally required for the program. The thesis must be expressed in a satisfactory literary form, consistent with the discipline concerned, and must display a scholarly approach to the subject and thorough knowledge of it. A critical review of previous work related to the subject should usually be given.

A candidate will not be permitted to submit a thesis for which he or she has previously received a degree; however, with the permission of the Dean of the Faculty of Graduate Studies and Research, he or she may incorporate into the thesis material that was included in a previous thesis.

12.2 Master's Thesis

The master's thesis should embody the results of successful scholarly research in a specialized area. It should exhibit the candidate's knowledge of recognized techniques of investigation and critical evaluation, and be presented in a organized and systematic way.

(a)   Oral Examinations
Candidates are ordinarily required to undertake an oral examination of the thesis. Please refer to Thesis Specifications, section 12.5, item (d) (i) Master's, for submission deadlines.

The master's thesis will be examined by a board consisting of at least four members, including the thesis supervisor, the chair of the department concerned, an examiner from a department other than that of the candidate and one additional member from the department concerned.

The constitution of the examining board will be announced by the chair of the department concerned; both it and the thesis examination process are defined by guidelines, principles, and practices prescribed by the Faculty of Graduate Studies and Research.

(b)   Thesis Weight
Thesis weight (one to three full courses) must be identified at the time of admission. A change in the thesis weight at a later date would require the approval of the Dean of the Faculty of Graduate Studies and Research.

(c)   Research Essays and Independent Research Projects
Faculty regulations governing research essays and independent research projects are normally the same as those for master's thesis, and subject to the guidelines, principles, and practices prescribed by the Faculty of Graduate Studies and Research.

12.3 Doctoral Thesis

The doctoral dissertation must report, in an organized and scholarly fashion, the results of original research. The thesis must be a contribution to knowledge, and must demonstrate the candidate's ability to undertake sustained research and to present his/her findings in an appropriate manner.

(a)   Oral Examinations
The dissertation must be defended successfully at an oral examination. Please refer to Thesis Specifications, section 12.5, item (d) (ii) Doctoral, for submission deadlines.

The doctoral dissertation will be examined by a board consisting of at least five members, including the thesis supervisor, the chair of the department concerned, an examiner from a department other than that of the candidate, the members of the candidate's advisory committee, the Dean of the Faculty of Graduate Studies and Research or his delegate, and an external examiner who is a recognized authority on the subject of the thesis.

The constitution of the examining board will be announced by the Dean of the Faculty of Graduate Studies and Research; both it and the thesis examination process are defined by guidelines, principles, and practices prescribed by the Faculty of Graduate Studies and Research.

(b)   Thesis Weight
Thesis weight (ordinarily about half of the total Ph.D. requirements of ten full courses) must be identified at the time of admission. If the thesis weight falls within a range of credit weights, it should be assigned at the time of admission a weight corresponding to the lower bounds of that range. A change in the thesis weight at a later date would require the approval of the Dean of the Faculty of Graduate Studies and Research.

The work of each Ph.D. candidate will be assisted by an advisory committee of faculty members, who will aid him/her in his/her preparation for the final comprehensive examination, and assist in the evaluation of the thesis and oral examinations.

12.4 Deadlines

(a) Master's Thesis

A master's student expecting to graduate at the Spring Convocation must submit his/her thesis or dissertation to his/her supervisor, in examinable form, by *March 1*. A master's student expecting to graduate at the Fall Graduation must submit his/her thesis by *August 1*. A master's student expecting to graduate at the Winter Graduation must submit his/her thesis by *December 1*.

(b) Doctoral Dissertation

A Ph.D. student expecting to graduate at the Spring Convocation must submit his/her thesis or dissertation to his/her supervisor, in examinable form, by *March 1*. A Ph.D. student expecting to graduate at the Fall Graduation must submit his/her thesis by *August 1*. A Ph.D. student expecting to graduate at the Winter Graduation must submit his/her thesis by *December 1*.

12.5 Specifications

(a) The candidate must submit *six* typewritten copies (original and five acceptable duplicated copies, on bond paper) and must comply with special departmental requirements governing the form of the thesis, including methods of bibliographical entry, and the use of diagrams and tables.

(b) Each thesis or dissertation must be accompanied by a suitable abstract. The abstract of a master's thesis should not exceed 150 words, while the abstract of a doctoral thesis may be up to 350 words in length.

(c) Regulations regarding style, pagination, certification, acceptance, grade and size of paper, as well as abstracts, reproduction, microfilming, binding, and the constitution of the examining board will be prescribed by the Faculty of Graduate Studies and Research.

(d) (i) Master's

The candidate is expected to notify his/her supervisor and the chair of the department at least two weeks in advance of the date on which he/she intends to submit the completed thesis. The candidate is then expected to submit *six* copies of the completed thesis to the department at least *four* weeks in advance of the intended date of examination.The thesis examination and defence will then be scheduled and the date will be announced at least *two* weeks in advance. The department must deposit one copy of the thesis to the office of the Faculty of Graduate Studies and Research at least *two* weeks in advance of the actual date for the examination and defence.

(ii) Doctoral

The candidate is expected to notify his/her supervisor and the chair of the department at least *two* weeks in advance of the date on which he/she intends to submit the completed thesis. The candidate is then expected to submit *six* copies of the completed thesis to the department at least *six* weeks in advance of the intended date of examination.The thesis examination and defence will then be scheduled and the date will be announced by the Dean of the Faculty of Graduate Studies and Research at least *four* weeks in advance. The department must deposit one copy of the thesis to the office of the Faculty of Graduate Studies and Research at least *four* weeks in advance of the actual date for the examination and defence.

(e) The five unbound copies of the approved thesis submitted to the faculty for binding should be the original and four others, and they must be presented in order of pagination in separate envelopes. Two copies are maintained in the library, the third copy is given to the department, the fourth copy is for the candidate, and the fifth copy is for the thesis supervisor. If the thesis was supervised by two faculty members of the Faculty of Graduate Studies and Research will accept *six* unbound copies.

12.6 Licence to the University and to the National Library of Canada

In the interest of facilitating research by members of the Carleton community and by interested outsiders, and in consideration of his/her having been accepted as a graduate student at Carleton, the student author of a thesis or dissertation submitted in partial fulfilment of the requirements for an advanced degree, shall grant to the University and to the National Library of Canada a licence to make single copies or microfilms (solely for the purpose of private study and research, in response to written requests from individuals, libraries, universities, or similar institutions).

It is understood that the student author retains other publication rights, and that neither the thesis, nor the dissertation, nor extensive extracts from them may be printed or otherwise reproduced without the author's written permission.

12.7 Withholding of Thesis Deposition

If, at the time of submitting his/her thesis, the student elects to protect any rights to immediate commercial publication, or to obtain a patent which may arise from his/her research, or to keep his/her thesis out of circulation for other reasons, he/she

may apply in writing to the Dean of the Faculty of Graduate Studies and Research requesting that the thesis be withheld from deposit in the library:

(a) for an additional period of three months without reason

(b) for each additional period of six months, with reason (total period of restriction not to exceed two years)

The student must submit any request for extension of the restriction one month prior to the termination of the previous period. The student and his/her supervisor will be required to justify the extension of the restriction. Subsequent requests must follow the same procedure.

13. Time Limits for Program Completion

13.1 General Remarks
There are maximum time limits for the completion of programs. Candidates may also be subject to time constraints prescribed by individual departments to ensure orderly progress through the stages of their programs.

13.2 Master's Program
(a) *Full Time*

Full-time master's candidates must complete their degree requirements within six terms of registered full-time study. Students admitted to a ten-course master's program (that is, in the School of Public Administration, the School of Social Work and the School of Journalism and Communication) must complete their degree requirements within nine terms of registered full-time study.

(b) *Part Time*

A part-time master's candidate must complete his/her degree requirements within an elapsed period of six calendar years after the date of initial registration. Students admitted to a ten-course master's program (that is, in the School of Public Administration, the School of Social Work and the School of Journalism and Communication) must complete their degree requirements within an elapsed period of eight calendar years after the date of initial registration.

(c) *Combined Full Time and Part Time*

A master's candidate who elects to complete his/her program by a combination of full-time and part-time study is governed by the following elapsed-time limitations: five calendar years if the candidate is registered as a full-time student for two or three terms and part-time for the balance; four calendar years if the candidate is

registered four or five terms as a full-time student and part-time for the balance.

These limitations are calculated from the date of initial registration in the master's program.

(d) *Combined Full Time and Part Time (Ten-course Master's Program: School of Public Administration, School of Social Work and School of Journalism and Communication)*

A master's candidate who elects to complete his/her program by a combination of full-time and part-time study must complete the degree requirements within an elapsed period of eight calendar years after the date of initial registration in the master's program.

13.3 Doctoral Program
(a) *Full Time*

A full-time Ph.D. candidate who is admitted on the basis of a master's degree (that is, with a program of ten full courses or the equivalent) must complete the Ph.D. degree requirements within an elapsed period of six calendar years after the date of initial Ph.D. registration.

(b) *Part Time*

A Ph.D. candidate who undertakes the program by a combination of full-time and part-time study must complete the degree requirements within an elapsed period of eight calendar years after the date of initial registration in the Ph.D. program.

13.4 Exemption from Time Limit
When exemption from registration for a term or terms has been approved by the Dean of the Faculty of Graduate Studies and Research, this period will be exempt from the overall time limit allowed for completion of the program.

13.5 Extension of Time Limit
In exceptional cases, an extension of time permitting further registration (one or two terms) may be granted to a candidate whose recent progress, as judged by the department, has been otherwise satisfactory. Requests for extension of time should be directed to the Dean of the Faculty of Graduate Studies and Research through the department concerned.

13.6 Grade Review
Within *two weeks* of the release of grades or the announcements of comprehensive examination results or thesis results, a graduate student may request, through the Dean of the Faculty of Graduate Studies and Research, that one or more of his/her grades or results be reviewed. The charge for such a review is $25, which must accompany the review request. **Note:** The review process will not

take place if the fee is not remitted. If the grade is raised, the $25 charge is refundable.

13.7 Program Review
A graduate student has the right to request a review of decisions made concerning his/her graduate status or any other ruling relating to his/her program. All such requests are to be made in writing to the Dean of the Faculty of Graduate Studies and Research.

13.8 Records Retention Policy
Since 1990 the University has implemented a records retention policy which provides for the destruction of student file folders and their contents after a period of ten years has elapsed since the last registration. This policy applies to those students who are formally admitted and registered in degree programs. Further information on this policy can be obtained by contacting the Faculty of Graduate Studies and Research.

14. Instructional Offences

14.1 Regulations
The Senate of the University has enacted the following regulations for instructional offences at the graduate level:
Any student commits an instructional offence who:
(a) cheats on an examination, test, or graded assignment by obtaining or producing an answer by deceit, fraud or trickery, or by some act contrary to the rules of the examination
(b) submits substantially the same piece of written work to two different courses. Minor modifications and amendments or changes of phraseology do not constitute a significant and acceptable reworking of an essay or paper
(c) contravenes the regulations published at an examination or which are displayed on the reverse side of a properly authorized examination booklet
(d) commits an act of plagiarism. Plagiarism will be deemed to have occurred when a student either:
  (i) directly copies another's work without acknowledgement; or
  (ii) closely paraphrases the equivalent of a short paragraph or more without acknowledgement; or
  (iii) borrows, without acknowledgement, any ideas in a clear and recognizable form in such a way as to present them as the student's own thought, where such ideas, if they were

the student's own, would contribute to the merit of his or her own work
(e) disrupts a class or other period of instruction if he or she:
  (i) is a registered member of the class or period of instruction
  (ii) is warned to discontinue any act or behaviour reasonably judged by the instructor of the course or period of instruction to be detrimental to the class, and having ignored such warning is ordered by the instructor to leave and refused to leave
(f) Any student found in violation of these regulations may be:
  (i) expelled
  (ii) suspended from all studies at the University
  (iii) suspended from full-time studies;and/or
  (iv) awarded a reprimand
  (v) refused permission to continue or to register in a specific degree program but subject to having met all academic requirements shall be permitted to register and continue in some other program
  (vi) placed on academic probation
  (vii) awarded a Fail, or *Absent* in a course or examination
Allegations of instructional offence may be investigated by instructors and/or departmental chairs and, in all cases, will be reported to the faculty dean. The dean will promptly advise, in writing, the student and the university Ombudsman of the allegation and of the student's rights. The dean will review the allegation and, if not resolved at that level, the allegation becomes subject to final disposition by a tribunal appointed by the Senate. Information about procedure governing tribunals is available from the Clerk of the Senate, Room 607, Robertson Hall.

15. Offences of Conduct

15.1 Conduct Offences
The University has in place regulations and procedures to deal with allegations of misconduct made against students in the areas of discrimination and sexual harassment.

15.2 Discrimination
The University has enacted the following regulation:
  Any student commits a general offence who commits an act of discrimination on the basis of race, ancestry, place of origin, colour, ethnic origin, national origin, creed, sex, age marital status, family status, political affiliation or belief, sexual orientation, or

any handicap that is defined as such in the Human Rights Code of Ontario.

The University has also approved the following procedures for enforcement of this regulation:

1. An allegation shall be made in writing to the Dean of the Faculty in which the program to which the respondent has been admitted belongs or, in the circumstances where the respondent has not been admitted to a program, to the Dean of the Faculty where the majority of courses in which the respondent has registered are administered. An allegation against a student in residence when made by another student in residence which involves the complainant's enjoyment of her/his accommodation shall be made to the Vice-President (Academic).

The Dean, or the Vice-President (Academic), as the case may be, shall cause to have an investigation conducted and, upon receipt of the report of the investigation, shall either

1) dismiss the allegation on the grounds of insufficient evidence or lack of jurisdiction by the University, or
2) accept that the allegation is founded and seek the agreement of the respondent to a remedy, or
3) refer the matter to the President

A dean's dismissal of the allegation may be appealed, within ten working days, to the Vice-President (Academic) who may, in turn, either

1) again dismiss the allegation, or
2) accept that the allegation is founded and propose a remedy to the respondent, or
3) refer the matter to the President

In the case of students in residence, where the original allegation has been made to the Vice-President (Academic) and is dismissed, appeal shall be directly to the President who may either

1) again dismiss the allegation, or
2) accept that the allegation is founded and propose a remedy to the respondent, or
3) refer the matter to a tribunal appointed by the Senate

2. In the instance where the matter has been referred to the President, the latter shall decide whether or not the University shall conduct a hearing before a tribunal appointed by the Senate.

If the allegation is proven, the tribunal shall decide upon one of the following sanctions:

The student may be:
a) expelled
b) suspended for a period of time from all studies at the University
c) restricted in his/her use of University facilities; and/or
d) given a reprimand

Should the President decide not to conduct a hearing before a tribunal, the allegation shall be deemed to have been dismissed, but the President shall give written reasons for such a decision, and these reasons shall be communicated to the parties involved.

3. In the instance where the complainant wants redress from the University without the involvement of the respondent, or where the respondent is unknown or is not a member of the university community, and/or where there is a claim that the University has failed or has been negligent in providing a safe, non-hostile environment, the allegation of an offence shall be made in writing to the President, who shall cause an investigation to be conducted. Upon receipt of the report of the investigation, the President may order any relief he/she deems fit, and shall give written reasons for the decision, which reasons shall be communicated to the complainant.

Information about procedure governing tribunals is available from the Clerk of the Senate, Room 607, Robertson Hall.

15.3 Sexual Harassment

The University has approved a Sexual Harassment Policy which defines sexual harassment as follows:

1. Sexual harassment may occur irrespective of gender and is:
   a) unwanted attention of a sexually oriented nature, made by a person who knows or ought reasonably to know that such attention is unwanted; and/or
   b) an implied or expressed promise of reward for complying with or submitting to a sexually oriented request or advance; and/or
   c) an implied or expressed threat or reprisal for not complying with or submitted to a sexually oriented request or advance

Sexual harassment may include, but may not be limited to behaviour such as
- unwarranted touching
- suggestive remarks or other verbal abuse in a sexual context
- leering
- compromising invitations
- demands for sexual favours
- sexual assault

2. Sexual harassment may also be engaging in a course of sexual comment or conduct that is known or ought reasonably to be known to be unwelcome. This form of sexual harassment may affect individuals or groups. It may take the form of excluding an individual or a group from rights and/or privileges to which they are otherwise entitled.

3. Sexual harassment may be psychological, verbal or physical and may be all of these. It is behaviour prohibited by the University for all

persons and circumstances over which the University has jurisdiction. In some of its forms it may contravene the Human Rights Code of Ontario. Sexual assault is a crime pursuant to the Criminal Code.

4. Regulations governing the conduct of students and employees of the University are applied to those times and places at which the actions of such employees and students relate to or impinge upon their function as such.

The university's sexual harassment policy provides for advisory and mediation services to assist in resolving perceived situations of sexual harassment before they reach the level of formal allegation. Attention is drawn, in this regard, to the role of the university's two advisers on sexual harassment complaints, Dr. Nancy Adamson, Coordinator for the Status of Women, and Professor David K. Bernhardt, Department of Psychology.

The University has enacted regulations under which allegations of general offence (sexual harassment) may be made against students. These regulations state that a student commits a general offence who engages in conduct which constitutes sexual harassment as defined in the university's sexual harassment policy.

The University has also approved procedures for the handling of allegations of general offence (sexual harassment) against a student. These procedures, as well as the sanctions which a tribunal can impose, are the same as those outlined above for acts of discrimination, save and except that the investigators charged with the investigation which the Dean, the Vice-President (Academic), or the President, as the case may be, shall cause to have conducted, must be selected from the Panel of Investigators provided for under the terms of the university's sexual harassment policy.

16. Appeals and Petitions

16.1 Criteria and Procedures
Assuming that a graduate student has exhausted all avenues of appeal and petition with the Dean of the Faculty of Graduate Studies and Research (questions regarding the appeals process can be directed to the Office of the Dean at 788-2525), a graduate student may appeal the decision of the University to deny the award of degree or the required withdrawal of the student to the Senate upon certain specific grounds.

Such grounds are the allegation by the student that the student has been denied a degree or forced to withdraw because of some mistake, error or improper conduct by the University, its officers or employees.

A graduate student may petition the Senate to grant a degree or to stay a decision of required withdrawal on compassionate grounds.

Such appeals and petitions must be submitted in writing, within ninety days of receipt by the student of the decision which is to be appealed or petitioned, to the Clerk of the Senate, Room 607, Robertson Hall.

17. Graduation

17.1 Conferring of Degrees
On the recommendation of the Faculty of Graduate Studies and Research and with the approval of the Senate of the University, degrees are conferred by the Chancellor in the spring and fall of each year.

17.2 Application Deadlines
Candidates may have their degrees certified in February each year; they must apply by *December 1*. Students expecting to graduate at the Spring Convocation must apply for graduation in the Graduate Studies and Research office by *February 1*. Those expecting to graduate at the Fall Graduation must apply by *September 1*.

General Information

Hours of Operation

Bookstore
Labour Day to May
Monday to Thursday 9:00 A.M. – 9:00 P.M.
Friday 9:00 A.M. – 4:30 P.M.
There will be no refunds or exchanges without the Bookstore cash register receipt. Refer to the Bookstore refund/exchange policy, located in the store, for further details.

Business Office
Monday to Friday 9:00 A.M. – 4:00 P.M.
Evening Service
Monday *and* Thursday 5:00 P.M. – 7:00 P.M.

Library
Fall/Winter Terms
Monday to Friday 8:00 A.M. – 11:00 P.M.
Saturday and Sunday 10:00 A.M. – 11:00 P.M.
Spring/Summer Intersessions
Monday to Friday 9:00 A.M. – 5:00 P.M.
Saturday and Sunday Closed
Summer Term
Monday to Thursday 9:00 A.M. – 10:30 P.M.
Friday 9:00 A.M. – 5:00 P.M.
Saturday 12:00 NOON – 5:00 P.M.
Sunday Closed
Library closes for all statutory and civic holidays except Good Friday and Easter Monday.
Weekend hours are extended before the examination period.
These hours are subject to change.
For current Library hours, call 788-5621 (recording).

Alumni Association

Robertson Hall 510
Telephone: 788-3636
Fax: 788-3587
The Carleton University Alumni Association represents the 60,000-plus graduates of Carleton University. Membership is automatically extended to all graduates, and is available, upon request, to students who have completed five full credits but are no longer registered at Carleton.

The objectives of the Association are to advance the excellence and prestige of Carleton University as a distinguished institution of higher learning in Canada, and to encourage a spirit of loyalty, friendship, service and benevolence among the members.

The Alumni Association serves the University by promoting its well-being through contact with the graduates, the government, the public, the faculty, students and potential students. It is governed by the National Alumni Council.

All graduates with known addresses receive *Carleton University Magazine*. The Department of Development and Alumni Services maintains alumni records to assure a meaningful and continuing dialogue between alumni and the University.

Funds from alumni help to support the library, student aid and other specific projects.

The Alumni Association sponsors reunions and an alumni award program, and assists groups who wish to organize functions for alumni. The Association is a young organization and welcomes suggestions for programs and activities that would be of benefit to the University community.

Members of the Alumni Council for 1993-94:
D.B. Climo, B.A.1951, B.Com.1952 (President)
G.M. Larose, B.A.(Hons.)1969, M.A.1970 (Vice-President)
P.C. Pivko, B.Arch.1978 (Past-President)
Alan Bolster, B.Sc.(Hons.)1975
George Brown, B.A.(Hons.)1983
Gerard Buss, B.A.1973
Fiona Campbell, B.A. (Hons.) 1990
J.P. Cooper, B.A.1969
Paul Correy, B.Eng. 1974
C.P. Egan, B.A.1985, B.Com.1987
M.M. Epstein, B.A.1970
Christine Fisher, B.A. (Hons.) 1975, M.A. 1977
N.S. Gilkinson, B.A.1978
Zbigniew Gryz, M.A. 1973, Ph.D. 1980
Tracy Hall, B.A. 1987
Doug Hancock, B.A. 1983
Jennifer Higgins-Ingham, B.A. (Hons.) 1992
J.M. Kennedy, M.A.1991
Alan MacArtney, B.A. 1984
Michael Makin, B.J.1986
Jack McAuley, B.A. 1974
Patrick O'Reilly, B.Com. 1992
Greg Owen, B.A. 1991
Pamela Pavlik, B.J. 1980
Jim Rossiter, B.J. 1992
P.M. Rourke, M.A.1989
Sharon Smith, B.J.1985, M.A.1990
D.G. Thomson, B.C.S.1986
C.G. Watt, B.A.1957

Athletics and Recreation

Telephone: 788-4480
Fax: 788-4466
The athletics and physical recreation program at
Carleton, which plays an important role in
maintaining and enhancing university spirit, is
determined by the policies established by the
Athletics Board, a committee consisting of students,
faculty members and administrators. The Board
advises the University on matters of athletics and
recreation policy through the Office of the
President.

At the interuniversity level, Carleton is a member
of both the Ontario Universities Athletic Associ-
ation (for men) and the Ontario Women's Inter-
university Athletic Association. The Varsity men's
Ravens teams are basketball, football, cross-country
skiing, waterpolo, rugby, swimming, fencing and
soccer. The women's Varsity Ravens teams partici-
pate in basketball, volleyball, cross-country skiing,
waterpolo, field hockey, swimming, fencing, rowing
and soccer. Full-time graduate students are
eligible for interuniversity athletics, subject to
league regulations.

The intramural program includes touch football,
cross-country running, basketball, broomball, tennis,
softball, badminton, swimming, squash, team
handball and hockey. Some of these sports are
co-educational.

Carleton's athletics facilities include football and
soccer fields, five tennis courts, a broomball rink, a
fifty-metre swimming pool, fitness centre, squash
courts, Nautilus and heavy-weight training rooms,
combatives room, multi-purpose room, gymnasium,
sports medicine and sports therapy clinics. These
facilities are available for use by Carleton students
for organized and recreational sports activities.

Carleton International

D.R.F. Taylor, Director
Dunton Tower 1506
Telephone: 788-2519
Fax: 788-2521
Carleton International is best described as the
foreign office for the University and a clearing
house for information on Carleton's international
activities. Carleton has many formal academic link-
ages with other countries. These are administered
on behalf of the University by Carleton International
and many allow graduate students to spend a term
or a year abroad in study relating to their research.
Information and applications to participate in an
exchange as well as information on scholarships and

study/work opportunities abroad are available
through Carleton International. Application is
usually made in October/November.

Carleton International is also responsible for
liaison with the international and diplomatic
community and for the reception of foreign visitors
and delegations to the University.

Chaplaincy

For the past twenty years there has existed at
Carleton a chaplaincy service, part of whose function
has been to share experiences, insights, friendships,
and faith. It has also been involved in study and
discussion groups, community projects, develop-
ment education, marriage preparation, and
religious services. The chaplaincy service also
has connections with many organizations and
resources on campus, as well as with churches and
religious groups in the Ottawa area.

The two principal chaplains are the Reverend Neil
Hunter (Protestant-Ecumenical), who is located in
T28 and T30 Tory tunnel, and can be reached at
788-4449, and Father Michael Peterkin (Roman
Catholic), who can be reached at 237-5616 or 788-
2896 in room 127G Unicentre. People are encouraged
to visit at any time. Appointments are not necessary,
but at times they are advisable and can be arranged
by the support staff in the chaplaincy offices.

There is a quiet room next to the chaplaincy offices
in the Tory tunnel which is used for individual
meditation, religious services, and study-group
activity. It is open all day, five days a week. In
addition, Father Peterkin exercises a ministry at
Newman House, 1061 Bronson Place, that is open
to all as a house of hospitality and welcome, but
that can also accommodate smaller groups who
wish to meet there.

Computing and Communications Services

Robertson Hall 401
Telephone: 788-3700
Fax: 788-4448
Computing and Communications Services operates
several SUN Unix systems and Novell PC networks
that are available to graduate students. In addition,
many departments have their own facilities for
students.

Unix software available includes: SPSS, SAS, S+,
Mathematica, NAG, Matlab and PV-Wave. The PC
systems offer wordprocessing and access to the
Unix systems.

Additional information is available in the department's *Directory of Services* publication or online via the Info information service.

Counselling and Student Life Services

University Centre 501
Telephone: 788-6600
Fax: 788-3995
Counselling and Student Life Services is an educational resource centre available to all members of the University community. A qualified team of professionals offers a wide range of services and programs listed below.

All contacts are voluntary and strictly confidential. Information is only released upon the request and consent of the client involved.

Other types of assistance include appropriate on- and off-campus referrals when required, and consultation regarding the problems of another person.

The centre is located in room 501 of the Unicentre, with office hours from 9:00 A.M. to noon and 1:00 P.M. to 5:00 P.M. Further information about services and programs may be obtained from the centre in person, or by telephone at 788-6600.

• *Counselling Services*
Personal counselling can help individuals deal more effectively with emotional and social concerns. Individual and group approaches are used in providing counselling.

• *Career Counselling*
Educational and career counselling involves learning to plan wisely, handle difficulties and make decisions with regard to academic and vocational concerns. Relevant information generated by group discussion and testing is used in helping the client to determine goals and make choices.

• *Information Services*
A resource centre is maintained for use in educational and vocational planning. It includes materials on occupations, university and community college calendars, directories, and other types of career literature. Information regarding other sources of assistance at Carleton University and in the greater Ottawa community is also available.

• *Learning Assistance Program*
Various programs and activities are designed to create learning experiences which further the development of effective reading and study skills. Testing, instruction, and practice are provided to correct difficulties, and to improve the ability to learn and study. Individual and group approaches are utilized.

• *Campus Life Program*
The program provides direct and indirect service to students at the University. Its main goal is to assist new students in a variety of areas (e.g. academic, social and emotional) thereby easing the transition to life at Carleton University. In addition to initial activities, services and programs are offered throughout the year.

Various study skills workshops are offered during the academic year. It is important to realize that different styles of learning are required for high school and University. Get a head start on developing these skills further by registering for the study skills courses that would best fit your needs.

• *International Student Advisory*
The international student adviser is available to discuss particular concerns international students may have. A ten day orientation program is held every August for incoming international students. Information concerning University education, financial assistance, health coverage, immigration regulations and the general adjustment to a new living situation is available. We are here to help. Feel free to drop in at any time.

• *Group Programs*
These afford opportunities to be involved in a variety of experiences in which learning is best facilitated through group participation. They are offered periodically throughout the year. The nature and content of programs are publicized, along with dates and registration details.

• *Persons with Disabilities*
A variety of services and programs for persons with disabilities are offered by the Paul Menton Centre for Persons with Disabilities (see page 40).

Colonel By Child Care Centre

The Colonel By Child Care Centre is located on campus. Children between the ages of six months and five years are accepted. Priority admission is given to the children of students, staff and faculty members. The program is developmentally suited to the individual needs of three age groups — infants, toddlers, and preschoolers. The staff are trained in Early Childhood Education, Mothercraft (Toronto) or the equivalent. Parents form the Executive Committee of the Centre and are responsible for policy decisions and monitoring of the finances of the Centre.

The Centre is open twelve months a year with the exception of statutory holidays. Operating hours are Monday to Friday, from 8:00 A.M. to 5:45 P.M.. A hot lunch and two nutritious snacks are provided daily.

Fees are prepaid on a monthly basis. Fee subsidies are available from the Regional Municipality of Ottawa-Carleton for families who meet certain

qualifications. As the waiting list for admission is extensive, parents are encouraged to apply as early as possible.

For information, please call Margot Henderson, Coordinator, Colonel By Child Care Centre, 788-2715.

Fees

Fees at Carleton University are calculated on a composite basis to include tuition, the Students' Association and the Graduate Students' Association, Athletics, University Centre, and Health Services fees.

The University reserves the right to change all fees, charges, and refund policies without notice. The fee schedule published below was in effect for the academic year 1993-94 and is subject to change. Note: *Effective September 1994 (Fall term) the University will no longer be offering a partial fee waiver for full-time master's students registering in their third term or Ph.D. students registering in their third and sixth term.*

Canadian Citizens and Permanent Residents (Landed Immigrants)
• **Full-Time**
Master's Program and Diploma in Public Administration
*(first year of full-time study)

Tuition	$1016.00
Student Sickness/Accident Insurance†	49.05
Students' Association	48.15
Athletics	65.76
Health	17.79
University Centre	25.00
Total composite fee (per term)**	$1221.75

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* First and second year of full-time study for students in Public Administration, Social Work, and Journalism. (Fees for the School of Social Work may vary slightly).

† The student accident/sickness insurance coverage is based on a one-year period from September 1 to August 31. The insurance fee is payable once a year, at registration in September or January. Students registering solely for the summer term will not pay the insurance fee and will not receive coverage; however, those summer students previously registered in the fall or winter term will continue to receive coverage over the summer. For information on obtaining family coverage, for part-time students and refunds for those already covered elsewhere, please go to the C.U.S.A. office (room 401, University Centre) before October 1 (or February 1 for January registrations).

** This amount includes the compulsory insurance fee of $49.05. For students registering in May for their first term, there is no insurance coverage; therefore, the total composite fee for that term is the amount shown less $49.05.

*** Theses, Research Essays or equivalents are equated to two half-credits.

(second or subsequent year of full-time study)

Tuition	$508.00
Student Sickness/Accident Insurance†	49.05
Students' Association	14.43
Athletics	19.71
Health	5.34
University Centre	7.50
Total composite fee (per term)**	$604.03

Doctoral Program
(first and second year of full-time study)

Tuition	$1016.00
Student Sickness/Accident Insurance†	49.05
Students' Association	48.15
Athletics	65.76
Health	17.79
University Centre	25.00
Total composite fee (per term)**	$1221.75

(third or subsequent year of full-time study)

Tuition	$508.00
Student Sickness/Accident Insurance†	49.05
Students' Association	14.43
Athletics	19.71
Health	5.34
University Centre	7.50
Total composite fee (per term)**	$604.63

Qualifying Year
Arts, Journalism, and Science
Total composite fee (per academic year)** $2388.45
Engineering
Total composite fee (per academic year)** $2561.45

• **Part-Time** (one-half credit)

Tuition	$342.50
Students' Association	14.43
Athletics	19.71
Health	5.34
University Centre	7.50
Total composite fee (per term)	$389.48

• **Part-Time** (two-half credits)***

Tuition	$508.00
Students' Association	14.43
Athletics	19.71
Health	5.34
University Centre	7.50
Total composite fee (per term)	$554.98

International Students
• **Full-Time**
Master's Program and Diploma in Public Administration
*(first year of full-time study)

Total composite fee (per term)**	$4875.75

(second or subsequent year of full-time study)
Total composite fee (per term)** $2431.53

Doctoral Program
(first and second year of full-time study)
Total composite fee (per term)** $4875.75

(third or subsequent year of full-time study)
Total composite fee (per term)** $2431.53

Qualifying Year
Arts, Journalism and Science
Total composite fee (per academic year)** $8001.45
Engineering
Total composite fee (per academic year)** $12815.95

• **Part-Time** (one-half credit)
Total composite fee (per term) $1619.98

• **Part-Time** (two-half credits)***
Total composite fee (per term) $2382.48

Exemptions for International Students
Subject to the approval of the Dean of the Faculty of Graduate Studies and Research, the following categories of international graduate students are exempt from the international students' fee indicated above, and will instead be assessed the regular tuition fee:
1. Legal Dependents of Canadian citizens or Permanent Residents where the dependent status has been fully documented and has been established a minimum of three years prior to the student's application for exemption.
2. Persons and their dependents who have been recognized as Convention Refuges within the meaning of the Immigration Act or persons and their dependents who have applied for Convention Refugee Status prior to January 1, 1989.
3. Persons or dependents of persons admitted to and remaining in Canada under diplomatic visas or under the Visiting Forces Act.
4. Persons or dependents of persons, admitted to and remaining in Canada under clause 10(c) of the Immigration Act for the purpose of engaging in employment (other than graduate teaching and research assistants).
5. Persons or dependents of persons admitted to Canada under clause 10(a) or 10(b) of the Immigration Act who are sponsored and financially assisted by agencies such as the Canadian International Development Agency, the International Development Research Centre, The World Bank, The Inter-American Development Bank, the Asian Development Bank, the Caribbean Development Bank and the African Development Bank, by various aid

programs of the United Nations and its agencies, or by a recognized registered charitable organization.
6. Persons participating in a cultural exchange agreement between the Government of Canada and the government of another country or the Ontario–Jiangsu Academic Exchange Agreement or in a formal exchange agreement between Carleton University and a post-secondary institution in another country.
7. Persons who hold an Ontario Graduate Scholarship, or holders of an Ontario Graduate Scholarship who subsequently lose their scholarships, but who maintain the minimum acceptable grade level for Ontario Graduate Scholarship eligibility (B+) until completion of the program for which they had originally been granted the scholarship.
8. Recipients of the Government of Canada Awards awarded by the Department of External Affairs and International Trade.
9. Holders of Canadian Medical Research Fellowships and holders of Medical Research Council of Canada studentships.
10. Holders of the Ontario Attorney General's Graduate Fellowship in Law; holders of Graduate-Post-Graduate Scholarships for the Yemen Arab Republic and Oman or recipients of a Fulbright Scholarship awarded by the Foundation for Educational Exchange between Canada and the United States.
11. In addition, graduate students may be exempted pursuant to the initiatives aimed at attracting high quality international students (Differential Fee Waivers).

Graduate students who believe they qualify for exemption under one of the foregoing categories must submit documentation to support their claim to the Faculty of Graduate Studies and Research, Room 1516 Dunton Tower. Until a request for exemption has been requested and approved students will be assessed the international student fees.

Method of Fee Payment
Full-time and part-time fees are payable in full, by term. Winter-term courses registered for in September are payable on or before January 13.

Scholarships, bursaries, and loans administered by the University will be applied first to fees, provided that this is not contrary to the terms of the award.

Personal cheques will be accepted for the payment of accounts, but the University reserves the right to cancel this policy if it is abused. A service charge of $12.50 will be assessed for each cheque returned to the University as non-negotiable for any reason. Students are requested to provide their own cheques when making payments.

A statement of tuition fees paid will be available for income tax purposes by the end of February and

mailed to all students who have paid accounts in full. Students will be charged $15.00 *in advance* for each duplicate tax certificate requested.

Delinquent Accounts
Registration will not be complete until a satisfactory arrangement has been made for the payment of fees, and it may be cancelled should the student fail to meet these arrangements.

If a student owes the University *any* money at the end of an academic session, his/her account becomes delinquent.

Students with delinquent accounts will not have access to examination results, official transcripts, or duplicate diplomas *and will not be permitted to register again* until all monies have been paid in full by cash or certified cheque.

Withdrawal and Fee Credit
Students who are withdrawing from a course or courses, or entirely from the University, may do so via the Touchtone Voice Response Registration system, or by notifying the office of the Dean of Graduate Studies and Research, either in person or by letter. The official date of withdrawal is the date on which the notification is received. Partial credit of fees for students withdrawing will also be calculated as of that date. No partial credit of fees is available unless all required procedures have been completed by the student on or before the appropriate designated last date for withdrawal.

A withdrawal credit of the composite fee less a registration charge of $40 ($20 for 1.0 credit part-time; $15 for .5 credit part-time) may be made for withdrawals before the first day of classes. Between the first day of classes and the last day for late registration, the registration charge is $190 ($95 for 1.0 credit part-time; $65 for .5 credit part-time). After the last day for late registration, the tuition portion of the composite fee, less the latter registration charge, is amortized over the period from the first day of classes to the last day for withdrawal with partial refund credit. Students who registered for the fall and winter terms during the fall registration period and who complete all winter term withdrawal requirements by the last date for the fall-term examinations will receive a credit of the full composite winter term fee.

A detailed schedule of withdrawal credits is available at the office of the Faculty of Graduate Studies and Research.

Miscellaneous fees are not refundable after the last day for late registration. Late registration fees are also not refundable.

The accident/sickness insurance fee is refundable only through the office of the Carleton University

Students' Association by October 1 (February 1 for January registrants).

Withdrawal from course(s) with partial credit of fees will not be permitted after these dates:*
1994 Spring/Summer Term – July 22
1994 Fall Term – November 4
1995 Winter Term – March 3
* For further details please consult the Academic Schedule, page 9.

Tuition Fees: Senior Citizens

All persons 60 years of age and over as of the last day for late registration may register in degree-credit courses and have their tuition fees waived. The charge to these students is a $5 per session registration fee and accident/sickness insurance charge (applicable to full-time studies).

Other Charges

Late Registration Charge
The late registration charge is assessed according to the date registration is completed and is non-refundable.
Full-time Students $120
Part-time Students $30

Appeals
To cover administrative costs, the charge for each appeal is $25, which is refundable if the appeal is successful.

Application
To cover administrative costs, a non-refundable charge of $25 (Can. or U.S. funds) is required with each application.

Student Identification Cards
A charge of $12 will be assessed for the replace-ment of student identification cards. Returning students will be requested to pay this amount at registration in the event that the student's card is not available for validation. The identification card remains the property of Carleton University and it may be cancelled or withheld at the discretion of the University.

Transcripts
Each student is eligible to receive one free transcript at graduation. All other transcript requests will be processed after payment is made (in advance) to the Business Office, at the rate of $6 per transcript. Mailing address: Transcript Clerk, Room 315, Roberton Hall, Carleton University, 1125 Colonel By Drive, Ottawa, K1S 5B6.

An extra charge per transcript will be added to offset the cost of faxing transcripts at the request of students as follows: Ontario $3.25, rest of Canada $5.25, outside Canada $8.50.

Reinstatement

Students who fail to observe continuous registration requirements must apply for reinstatement if they wish to continue their studies. If reinstated, students must pay a reinstatement charge which consists of $25 plus the equivalent of two half-credit course tuition fees for each term in which they failed to register.

Diplomas

Diplomas are issued at the time of graduation or are mailed to students who are unable to attend Convocation ceremonies. Students who require a replacement diploma due to loss or damage of their original diploma may order a Display Diploma by contacting the Office of Admissions and Academic Records, Room 405, Robertson Hall, 1125 Colonel By Drive, Ottawa. The charge for a Display Diploma is $80 (unframed), $140 (framed).

Gowns and Hoods

At each convocation, the University makes available to graduating students the appropriate academic regalia. The regalia will be available at a time and location to be announced in advance.

Graduate Students' Association

University Centre 511A
Telephone: 788-6616
The Graduate Students' Association (GSA) is a fully autonomous group which represents all full- and part-time graduate students at Carleton. The GSA is comprised of a council of departmental representatives and an executive elected annually. The GSA represents graduate students in many different forums, including University committees. The GSA is represented at provincial and federal levels through the Ontario Graduate Association (OGS) and the National Graduate Council (NGC).

The GSA provides specific services oriented to graduate students, as well as access to the services provided by CUSA. One of the GSA's primary goals is to promote interaction between graduate students and different departments through the organization of numerous social and academic events. The development of links with the wider University community, especially other on-campus associations, is a priority of the Association.

To obtain more information about the GSA call 788-6616, or drop by room 511A in the Unicentre.

The GSA also operates Mike's Place, a small pub, which is located on the second floor of the Unicentre, telephone 788-6681.

Health Services

University Centre 600
Telephone: 788-6674
Fax: 788-4059
An on-site health service is provided to protect and improve the physical and mental health of the students, staff and faculty. The clinic's responsibility is to provide consultation, treatment, and advice on matters of health, and to ascertain the fitness of students to perform academic work. The clinic is staffed by physicians, psychiatrists, social workers, nurses, a health educator. When the necessary service cannot be provided, appropriate referrals are made. Confidentiality is respected at all time.

Students who become seriously ill when the clinic is closed should go to the nearest hospital emergency. For problems of a less serious nature a doctor is on-call after hours and can be reached by telephoning the clinic.

Health Services is located on the sixth floor of the Unicentre. Office hours are Monday to Friday, 9:00 A.M. to 5:00 P.M. Evening appointments are available during the academic year. Please call 788-6674 for an appointment.

The health educator provides on-going educational programs and trains student "peers" to facilitate workshops on responsible drinking, sexuality, nutrition and wellness, etc. For further information contact the clinic.

Health Regulations

Medical insurance is compulsory for all full-time students. It is the student's responsibility to provide the insurance number when receiving medical care.

All Ontario residents should obtain a health number. Students whose home residence is outside Ontario should have coverage under their own provincial plan. All provincial plans are recognized by Health Services and billed directly. Students from outside Canada should contact the Ministry of Health office directly at 75 Albert Street, Ottawa, 783-4400. Students are automatically covered by an extended health care plan which covers a portion of other medical expenses (drugs, etc.) Questions concerning reimbursements should be directed to Carleton University Students' Association on the fourth level of the Unicentre.

Immunization Record

It is recommended that students personally insure adequate immune status. This means documented evidence of appropriate vaccines. If status is

uncertain vaccination is recommended. This includes German measles, red measles, mumps, tetanus, polio and others when appropriate.

Housing and Food Services Residences

Stormont-Dundas Residence 261
Telephone: 788-5612
Fax: 788-3952

Residences

Carleton's student residence complex is home to over 1,600 students each academic year. Graduate students are housed in a separate building which has single rooms in single sex or co-educational environments. Washrooms are shared between two rooms. The building also has study and television lounges, a laundry room and open space for relaxation or group discussions. All residence students receive a meal plan providing lunch and dinner, seven days per week. There are no facilities on campus for married students. Graduate students wishing to apply to live in residence should make inquiries to the office of the Faculty of Graduate Studies and Research.

Off-Campus Housing

An off-campus housing information service is available to students who are unable to obtain or do not wish to have on-campus residence accommodation. The service has been established to assist out-of-town students, but is in no way a rental agency.

Listings of available accommodations are posted in the corridor outside 261 Stormont. This area is open seven days a week, night and day. Listings of accommodation are not mailed out as such lists become outdated too rapidly. The off-campus listings are also available at any terminal on campus by typing "HOUSING" when the command "enter class" appears. The University does not undertake to inspect or approve any of the facilities listed by the off-campus housing section.

Food Services

All students residing in residence are provided with fourteen meals a week (lunch and dinner). The breakfast plan is optional, and is not included in the residence fees.

Students living off-campus may use the residence dining facilities by purchasing a campus dining plan, or eating individual meals in the dining halls. Campus dining plans purchased by students are not subject to provincial sales tax. Additional dining, cafeteria, and vending facilities are located throughout the campus.

For further information, students should contact the Student Housing Office, 2nd level Stormont House Residence.

Inventions, Technology Transfer and the Graduate Student

Robertson Hall 501
Telephone: 788-3808
Fax: 788-3980

In the course of their research activities graduate students at Carleton University sometimes make discoveries that have commercial potential. There is a process that enables inventors at Carleton University to seek protection for their ideas and to enter partnerships to seek commercial possibilities.

Initially a graduate student contacts the Technology Development and Commercialization Office of the Faculty of Graduate Studies and Research. If reasonable commercial possibilities exist, the student proceeds to the Carleton University Development Corporation for further action.

Carleton University Development Corporation (CUDC) is wholly owned by Carleton University. CUDC's mandate is to support the academic and research activities of the University primarily through the production of revenues from commercial endeavours. The Corporation's principal activities, in which other private sector companies may be involved, are technology transfer, training and professional development, and development of University owned lands.

CUDC has a strong commitment to the advancement of research, technology and training both at Carleton University and with the community at large. The Corporation's activities are potentially of direct interest to some graduate students.

• *Technology and Intellectual Property*
CUDC manages the development and commercialization of technologies and related intellectual property. The technologies may come from Carleton University or the community at large.

• *Training and Professional Development*
Training opportunities for professional development are available in business and management development, workplace skills development, spatial information systems, total quality management, technology-mediated training, and executive development.

• *Technology and Training Centre*
Plans are being developed for a multi-tenant building located on the campus of Carleton University which focuses on technology development and training.

The facility will complement current Carleton University initiatives in moving research to development and commercialization and encourage spin-off

companies associated with CUDC and Carleton University through a business incubation centre.

Additionally, the facility will provide the space and services for high quality technical training through CUDC's training division and offer outstanding management services and support to the occupants.

• *Opportunities for Graduate Students*

Graduate students may seek opportunities to protect their inventions and to set up companies in the new business incubator, or to work with enterprises associated with the technology and training centre. Students can be involved with research being conducted on campus as a result of the relationships with research organizations developed with the assistance of CUDC.

CUDC Organization

The 1993-94 Board of Directors consists of the following individuals:

R.M. Cruikshank, Board Chairperson
J.W. ApSimon, Associate Vice-President (Research) and Dean of Graduate Studies and Research, Carleton University
D.J. Brown, President and Chief Executive Officer, CUDC
D. Doyle, President, Doyletech Corporation
R.H. Farquhar, President, Carleton University
A.J. Freiman, Colliers, Businessperson
S.F. Hughes, Chairman, Corporation House
W. Joe, Businessperson
W.M. Nicol, Nicol and Lazier, Barrister
Z. Vered, President, Ron Engineering and Construction

Library

MacOdrum Library
Telephone: 788-5621 (hours recording)
Fax: 788-2750

The University library is located on the south-west side of the main quadrangle. The collection consists of over one million books and periodicals and more than 900,000 microfilms, microfiche, cassettes and discs. The majority of these items are on open shelves. The map library, with 145,000 maps and atlases, is housed in the Loeb Building, Room D299.

The library collection is arranged alphabetically by call number, starting with the letter "A" on the fifth floor and ending with "Z" on the first floor. The first floor houses audio-visual, instructional television (ITV) tapes, theses, and photocopy services; the second (main) floor contains reference and information, documents, circulation, Data Centre and interlibrary loans services; the third floor holds the library administration

offices; the fourth floor houses microform services and microcomputer labs; and, the fifth floor contains special collections and archives, and additional microcomputer labs. Seating is available on all floors.

Many electronic library services are offered: CD-ROMs, online literature searching, online library catalogue (CUBE) terminals, University of Ottawa library terminals and access to campus network services.

The library is governed by Senate-approved regulations, full copies of which are available at the circulation desk. Alumni of Carleton University and the general public, on payment of an appropriate fee, may purchase a borrower's card which will allow for limited borrowing privileges.

Undergraduate students may borrow for two weeks. Graduate students and students in the fourth year may borrow for four weeks, but books are subject to recall if requested by another patron after the first two weeks. Borrowers with three overdue books will have their borrowing privileges automatically suspended until all items are returned. Books placed on reserve may be borrowed for five days only, overnight, or on an hourly basis.

Registered students are able to borrow materials in person at other Ontario University libraries. Various reciprocal agreements exist with the University of Ottawa to support the joint programs. Users may enquire about this direct borrowing program at the circulation desk. The library also participates in IUBP (Inter-University Borrowing Program) and issues cards to students wishing to borrow from Quebec universities. The Centre for Research Libraries, considered an extension of the University library, offers students access to their library materials through the interlibrary loans department.

The library collection is protected against theft by an electronic book detection system. As a condition of use of the library, all users must submit books, briefcases, bags, etc. for inspection at the exit if requested to do so. Late return fines and billing costs are charged for overdue books and, as noted under "Delinquent Accounts", examination grades and transcripts will be withheld from students owing money to the University.

Ombuds Services

Jim Kennelly
University Ombudsperson
University Centre 511
Telephone: 788-6617

Ombuds Services deals with a variety of grievances and complaints as well as with requests for

information. On-campus and off-campus problems are handled by the staff (i.e. academic appeals, landlord-and-tenant problems, consumer problems, etc.). All discussions with the Ombudsperson are kept confidential. Financing of this service is provided equally by the University and the Students' Association (CUSA).

Paul Menton Centre for Persons with Disabilities

Assistant Director, Special Needs
Learning Specialist
University Centre 500
Telephone: 788-6608
TDD: 788-3937
Fax: 788-3995

Coordinator, Physical Disability Programs
Attendant Services Coordinator
Satellite Office: Residence Commons 223
Telephone: 788-2600 (ext. 5590)

• *Requests for Service*
The Paul Menton Centre provides individualized support services to persons who are deaf or hard of hearing, with learning disabilities, visual impairments, head injuries, physical disabilities including mobility impairments, or have psychiatric or other health problems.

Students are responsible for applying for special services. These services may include, but are not limited to: interpreters, notetakers, scribes, readers, and photocopying services, as well as requests for special arrangements for examinations and the use of adapted computers and other technical devices. All requests will be considered on an individual needs basis. Requests must be submitted at least four weeks before term begins. The Paul Menton Centre cannot guarantee that requests made after this time will be processed in time for the term/course requested. The Centre will accommodate as many requests as resources permit.

• *Counselling*
The Paul Menton Centre staff are available for confidential counselling appointments. Student with permanent or temporary disabilities are welcome to make appointments for any personal or student-related difficulties they may encounter.

• *The Study Centre for Persons with Disabilities*
A study centre, managed by the Library and located in Room 232 MacOdrum Library, has been equipped with technical devices for use by students with disabilities. Equipment available includes four desktop computers (a 286, 386, an XT and a voice activated Dragon Dictate system) furnished with

mainstream software such as WordPerfect 5.1 and 6.0, Lotus 123, dBase 4, Procomm Plus (for access to the Library's CUBE system), Right Writer (grammar check), large print and voice hardware/software programs. Also available are a Kurzweil scanner, Visualteks and a brailler. Anyone wishing to access the Study Centre to use the computers or other technical devices should be referred by the Paul Menton Centre to the Technical Devices Coordinator in Room 232 of the MacOdrum Library.

• *Assistive Technical Devices*
In addition to the equipment available in the Study Centre, a limited number of portable computers, two and four-track tape recorders, and personal FM systems are available. To borrow this equipment, students should obtain *written* referral from the Paul Menton Centre and equipment may then be picked up from Instructional Media Services, Room 617 Southam Hall.

• *Blind or Visually Impaired*
The Study Centre in the MacOdrum Library is equipped with computers with large print and voice hardware-software programs, a Kurzweil scanner and other technical devices which would be of assistance to students who are blind or have visual impairments. In conjunction with Reader Services of MacOdrum Library, students can request transcription of texts into braille, large print, computer disk or cassette form. Requests can take up to four months to process. Contact Sylvia Gruda, Reader Services, 788-2600, ext.2736 (see also Request for Service and Study Centre sections).

• *Deaf or Hard of Hearing*
A variety of services and resources are available through the Paul Menton Centre to students who are deaf or hard of hearing.

The Centre acts as liaison for the Educational Support Services program. The ESS program provides interpreter service, notetakers and personal FM systems for eligible part-time students. Students must apply at least four weeks before courses start, to access service. Full-time students may be eligible for services through Vocational Rehabilitation Services (VRS) or other funding agencies. It is the student's responsibility to initiate early enquiries. It is not unusual for an eight month to one year waiting time for a VRS appointment. Students should contact the Centre for more information (see also Request for Service and Study Centre sections).

• *Students with Learning Disabilities*
It is the intention of faculty and staff at Carleton University to accommodate the special needs of students with documented learning disabilities. It is recommended that the student have a recent psychoeducational assessment available in order that

university staff may provide services that address each individual's particular learning disability. However, if a psychoeducational assessment is unavailable, one may be administered.

Students seeking help with their particular learning disability, or information with regard to Carleton University's policy for students with learning disabilities may initiate enquiries with the Centre. Students wishing to be tested or retested should seek information at this office (see also Requests for Service and Study Centre sections).

• *Mobility Impaired*

The campus of Carleton University is well-equipped for accommodating persons with physical disabilities. The buildings are in close proximity to each other and most are connected by tunnels. All of the main buildings have elevators and are ramped for outside entrance and egress. Many sidewalks have been made accessible by recent curb-cut renovations. A building-by-building accessibility inventory is available from the Centre. (See also Requests for Service and Study Centre sections)

• *Residence Attendant Services Program for Students with Disabilities*

The Carleton Residence Attendant Services Program offers 24-hour assistance with activities of daily living such as personal care, room chores, cafeteria assistance, etc. The program is available to students with various levels of disability and attempts to respond to each individual according to their specific needs. In order to provide comprehensive services only a limited number of program spaces are available each year. A guide describing the program in detail along with other information is available free of charge by contacting the Attendant Services Coordinator at 788-6615.

For students who need an accessible room in residence but do not require attendant services, a limited number of rooms are available based on the following criteria: the need for special accommodation, level of disability, whether the applicant has housing alternatives in the area, and the date of application. For further information contact the Accommodations Officer in Housing and Food Services at 788-5612.

• *Non-Visible Disabilities*

Students with non-visible disabilities may have legitimate needs which are not easily recognized or understood with the university community. Students with psychiatric, medical or other non-visible disabilities are encouraged to contact the Paul Menton Centre to discuss personal and or academic issues of concern to them.

• *Brochures*

Informational brochures and flyers on resources and services available to students with disabilities at

Carleton University may be obtained at the Paul Menton Centre free of charge.

• *NEADS*

The National Educational Association of Disabled Students' administrative office is located at Carleton University. Enquiries regarding this national advocacy association can be made to Frank Smith, Room 513, University Centre (613)233-5963 V/TDD.

• *Carleton Disability Awareness Centre (CDAC)*

Funded by CUSA, CDAC is an information/resource/advocacy and drop-in centre. Located in Room 513, University Centre, CDAC is open Monday to Friday. All are welcome. Telephone 788-6613 V/TDD.

Placement and Career Services

University Centre 508
Telephone: 788-6611
Fax: 788-5695

Placement and Career Services in the on-campus student employment centre. Services provided by this office include:

• *Job Postings*

Casual, part-time, and summer jobs are posted on the self service job boards within the office. Full-time jobs are posted in binders in the reference library.

• *On Campus Recruiting*

Each year a number of employers from the private and public sectors visit Carleton to recruit graduating students seeking permanent employment. Recruiting begins in mid-September and continues until March. Deadlines for applications are advertised in *The Charlatan* newspaper once every two weeks and are also posted in the *Bi-Weekly Bulletin* in the showcase outside of the office.

• *Alumni Referral Services*

Throughout the year, employers contact us seeking qualified candidates for immediate job openings. All positions are posted in the office and then selectively file searched. A file search involves contacting qualified Carleton alumni registered with the service and referring them to employers. Alumni may register with the service one month prior to graduation and remain on file up to three years after graduation.

• *Employment Counselling*

Weekly sessions on resumé writing, covering letters, interview techniques, job search and networking skills are provided by the Centre. Students and alumni may register to attend at the office of the Centre. A resumé critiquing service is also available to session participants.

• *Reference Library*

Students can review material from the reference library in the office. The library contains literature on employers, company videos, job search materials, work abroad programs, salary information, and telephone books from cities across Canada.

Status of Women

St. Patrick's Building 444
Telephone: 788-5622
Fax: 788-4037

In January 1983, the University established the position of Status of Women Coordinator to facilitate structural changes at the University to address status of women's issues. If you have a personal concern, or would like to explore opportunities for women at the University, you are welcome to drop by the office or make an appointment to see the Coordinator. The secretary for the office, Cheryl Macaulay, is in 446 St. Pat's (788-5622) between 8:00 A.M. and 4:00 P.M., weekdays. The Coordinator, Nancy Adamson, normally works between 9:00 A.M. and 5:00 P.M. but is also available for evening appointments.

Carleton University Students' Association

University Centre 401
Telephone: 788-6688
Fax: 788-3704

All registered full- and part-time students are members of the Carleton University Students' Association (CUSA). CUSA has many functions; providing services to students, creating community awareness of our campus, and representing student views on a wide range of internal and external issues.

The policy body of CUSA is a thirty-four-member Students' Council consisting of representatives from each faculty and a president and finance commissioner elected annually by the student population. Elections take place in February for a twelve-month term which commences the following May. The graduate representative is chosen by the Graduate Students' Association in October.

Student services funded or operated by CUSA include:

• Careers Programing
• Carleton Disability Awareness Centre
• Carleton Foot Patrol
• Gay, Lesbian and Bisexual Centre
• International Students' Centre
• Mature and Part-time Students' Centre
• Off-Campus Centre
• Peer Counselling Centre
• Photo Centre

• Student Academic Action Bureau
• Women's Centre
• Volunteer Bureau

CUSA business ventures include:

• Copy Shop
• Games Room and Arcade
• Oliver's Pub
• Rooster's Coffeehouse
• Unicentre Store
• Unicentre Pharmacy

CUSA provides funding for *The Charlatan* newspaper and CKCU 93.1, an FM station which broadcasts throughout the National Capital region.

CUSA also sponsors an assortment of clubs and societies, alternate education programs, speaker series and concerts.

All CUSA operations are located in the University Centre building (Unicentre). The Unicentre, which is open from 7:30 A.M. to 2:00 A.M. daily, also houses food service facilities, the Faculty Club, Health Services, Placement and Career Services, Counselling and Student Life Services, and the Ontario Public Interest Research Group (OPIRG).

CUSA represents the students' interest at all levels of government and administration. It is an active member of both the Canadian and Ontario Federation of Students, organizations committed to bringing about necessary educational, administrative or legislative change in those areas affecting students.

The Students' Association is continually working to improve and expand its scope of activities. Please feel free to make your ideas and opinions known to your elected representatives.

Student Participation in Academic Affairs

There are several ways in which students may become involved in academic issues on campus.

Students may join the New University Government (NUG). NUG is an organization which gives students direct input into academic decisions, by filling the student representative positions at departmental meetings. As a result of such representation, students have direct input into curriculum committees and hiring boards, as well as routine departmental issues. Each department has at least one graduate NUG representative. Each faculty is entitled to send two representatives to the Graduate Faculty Board, and two of these student representatives are elected to the University Senate, where most of the general academic decisions are made.

There are several Senate policy committees, which have graduate student representation. These

include the Library, Computer, Admission and Studies and the Academic Planning committees. There are other Senate committees, but to date they do not have spaces reserved specifically for graduate students.

Finally, there is the GSA council, where representatives from every department meet not only to discuss academic issues, but to formulate GSA's policies on academic matters which may be presented to the Senate or other university committees.

To obtain more information on any of these, please call the GSA at 788-6616, or drop by the office at Room 511A in the Unicentre.

Awards and Financial Assistance

General Information

Medals
• The Governor General's Medal — Graduate Level
Awarded annually to a graduating student of very
high academic standing in a master's or doctoral
program of study. Donor: His Excellency the
Governor General of Canada. Established in 1988.

• University Medal at the Ph.D. Level
Awarded at each convocation ceremony, when
merited, to a graduating student for outstanding
academic achievement at the Ph.D. level. Established
in 1982.

• University Medal at the Master's Level
Awarded at each convocation ceremony, when
merited, to a graduating student for outstanding
academic achievement at the master's level.
Established in 1982.

Awards Policy
In recent years Carleton graduate students have won a
large number of external scholarships, such as SSHRC
fellowships, NSERC scholarships and Ontario
Graduate Scholarships. In addition, the University
itself provides generous support, and the majority
of graduate students receive funds from this source.

Holders of awards must pay regular tuition fees
unless otherwise stated.

Full-time graduate students at Carleton University
are expected to comply with the following procedures:
• Any full-time graduate student who accepts an
award that is not directly administered by
Carleton University must immediately inform
his/her departmental chair and the Dean of the
Faculty of Graduate Studies and Research in
writing. This requirement applies to any awards
or assistance offered by any agency or institution.
• Any full-time graduate student who accepts
part-time employment outside the University is
required to inform his/her departmental chair and
the Dean of the Faculty of Graduate Studies and
Research, in writing, prior to undertaking the
work.

Application Deadlines
March 1 is the last date for receipt of completed
applications for admission (including transcripts,
letters of reference, etc.) from candidates who wish
to be considered for the initial award, announced
April 1, of financial assistance administered by
Carleton University.

Candidates whose applications are received after
the March 1 deadlines may be eligible for the award
of a scholarship and assistantship by reversion.

Method of Payment
All awards administered by Carleton University
will be paid on a monthly basis, with the first install-
ment on **September 30.**

*Students are urged to note the above payment dates
and be prepared to be financially self-sufficient
during the month of September.*

Other Awards
A number of national and provincial organizations
award fellowships and scholarships which are
tenable at Carleton University (for example, SSHRC,
OGS, NSERC, etc.) Some application procedures
and regulations concerning fellowships awarded by
agencies other than Carleton University are given in
the description of each of these awards.

In addition, a large number of foundations,
companies, fraternal organizations, and other
agencies offer fellowships and scholarships. A
booklet providing details of deadlines and application
procedures has been compiled and may be consulted
in the office of the Faculty of Graduate Studies and
Research.

The Faculty of Graduate Studies and Research
maintains an information system to assist the Carle-
ton community in identifying funding opportunities
for graduate studies. The information system is
available through the Internet Gopher© and
contains information on agency deadlines and the
application procedures.

Eligibility
In the case of fellowships, grants, scholarships, etc.,
for which students must make application, it is the
individual student's responsibility to establish
his/her eligibility. Should it become known that a
student is unqualified for any reason, he/she must
return the funds already received, with the University
assuming no responsibility.

Departments recommending students for internal
awards must accept full responsibility for the
eligibility of their nominees.

Students are urged to consult carefully the bro-
chures and announcements which specify the
conditions associated with tenure of individual

awards. This information is available in the office of the Faculty of Graduate Studies and Research and in departmental offices.

Awards Administered by Carleton University

The awards administered by Carleton University are derived from a variety of sources. Throughout the years, a number of individuals and organizations have contributed substantial funds to the University, through bequests and donations, in order to help support students in various fields of study.

It is not always possible to identify precisely the sources of various donations and bequests (often small, but most important in the aggregate) from which any graduate student's financial support has been constructed. These sums, together with the assistantship funds made available from the University budget, make up the reservoir from which the Carleton scholarships and assistantships are drawn.

In the following cases, however, either because of the relative importance of the contribution or because of the fact that it is earmarked for a specific type of student or program, we do identify the external source from which the award has originated.

Duncan M. Anderson Memorial Bursary

This bursary was endowed in 1992 by colleagues, former students and friends of Duncan M. Anderson, who was a professor in the Department of Geography from 1964-1992. It is awarded annually to a deserving full-time student enrolled in the graduate program in geography who is in need of financial assistance, and whose studies relate to land use planning, resource management or geographic aspects of the environment. Application is not required. The name of the recipient will be announced by the Dean of the Faculty of Graduate Studies and Research, on the recommendation of the Chair of the Department of Geography.

The Association of Palestinian Arab Canadians Graduate Scholarship

This scholarship was established in 1988. It is awarded annually to an outstanding recent graduate of the following Palestinian universities: Bier Zeit, Al-Najah National, Al-Khaleel (Hebron), Bethlehem, The Islamic University of Gazza and Al-Quds (Jerusalem).

The recipient will be chosen by an awards committee chaired by the Dean of the Faculty of Graduate Studies and Research from nominations made by the students' home institutions. It is hoped that the recipient will return to a teaching position in a Palestinian University.

Auto-Carto Six Scholarship

This scholarship is awarded annually to a graduate student in geography studying computer-assisted cartography. The scholarship will be awarded, on the recommendation of the Department of Geography, on the basis of academic merit as determined by the academic index used by the Faculty of Graduate Studies and Research.

Walter Baker Fellowship

In honour of the distinguished contribution of the late Walter Baker to Canadian politics, parliamentary life and public administration, and his long-standing dedication and service to the Ottawa community, Minto Construction Ltd. has established the Walter Baker Fellowship. It is awarded annually to an outstanding student entering the School of Canadian Studies M.A. program. Application is not required; the recipient will be chosen by the graduate awards committee from a list of candidates recommended by the Director of the School of Canadian Studies.

Fred Barkley Special Bursary

This bursary, in the amount of $500, is awarded annually to a graduate student from a developing country who requires special financial assistance in order to study at Carleton University. The recipient of the award will be announced by the Dean of the Faculty of Graduate Studies and Research each year.

Harold Bernstein Memorial Award in Physical Chemistry

This grant, valued at approximately $1,000, will be awarded annually to a student joining the graduate program of the Ottawa-Carleton Institute to study and do research in the area of physical chemistry. It is a one-time scholarship, and is additional to all other stipends or scholarships that the student may hold.

The award is named in honour of Dr. Harold J. Bernstein, eminent spectroscopist and researcher, who retired from the National Research Council, Ottawa in 1979. Dr. Bernstein served as an adjunct professor of chemistry at Carleton University from 1970 to 1979.

Dr. Thomas Betz Memorial Award

Established in 1990 by family, friends and colleagues in memory of Dr. Thomas Betz, this award is open to undergraduate and graduate students, and is awarded annually, when merited, on the basis of scholarly promise and potential for intellectual leadership. The recipient will be chosen on the recommendation of a selection committee chaired by the Dean of the Faculty of Graduate Studies and Research, from a list of candidates nominated by departments, schools and institutes.

Board of Governors' Graduate Student Bursaries

Established in 1992 by members and friends of Carleton University's Board of Governors on the occasion of Carleton University's 50th Anniversary, these bursaries are available to graduate students who need financial assistance to cover tuition fees.

Application should be made to the chair/director of the student's academic unit. The final selections will be made by the Dean of the Faculty of Graduate Studies and Research from a list of names recommended by each academic unit.

Broadbent-Jewett International Bursaries

In recognition of the leadership of J. Edward Broadbent in Canadian politics and in recognition of the contributions of Pauline Jewett to international and academic affairs, the New Democratic Party of Canada has established two bursaries in their honour to assist students in need. Valued at $1,000 each, these bursaries are awarded annually to foreign students who have been accepted to the M.A. program in International Affairs but are in need of financial assistance in order to be able to study in Canada. The recipients will be selected each year by the Dean of the Faculty of Graduate Studies and Research, on the recommendation of the Director of the School of International Affairs. Established in 1992 by the New Democratic Party of Canada.

Peter Browne Memorial Scholarship Fund

This scholarship was established in 1983 by students, friends and colleagues of the late Professor G. Peter Browne. The recipient will be chosen by the awards committee upon the recommendation of the Department of History from among those students who apply. Preference will be given to deserving history graduate students who are nearing the completion of their thesis.

Dr. John David Burton Award

Awarded annually, when merited, to a student in good standing enrolled in a program at Carleton University, University of Ottawa, La Cité Collégiale or Algonquin College who has made a significant contribution toward awareness, equality and integration of persons with disabilities within his/her educational community.The recipient will be chosen on the recommendation of the Assistant Director (Special Needs), Counselling and Student Life Services at Carleton University, assisted by a Selection Committee. Edowed in 1992 by students, family and friends of Dr. John David Burton, who was a champion and advocate for persons with disabilities throughout his career as an educator.

CAL Corporation Scholarship

This scholarship, valued at $2,500, is provided annually by CAL Corporation. It is awarded to a student of outstanding performance studying for a graduate degree in electrical engineering and, who is working in the field of aerospace electronics with an emphasis on microwave technology, antennas or radar.

Application is not required. The recipient will be selected on the recommendation of the Scholarship Committee, composed of the chair of the department, one other faculty member, and a representative from CAL Corporation. The recipient of the award will be announced in January each year. In a given year, the award may not be made for lack of a suitable candidate, but will be held over so as to allow more than one recipient in a subsequent year.

Canadian Marconi Company Scholarship in Electrical Engineering

This scholarship, valued at $1,000, is awarded annually, on the basis of academic achievement and on the recommendation of the dean of Engineering, to a student enrolled in a graduate program in electrical engineering who is working in the area of analog electronic design, or antennas and prorogation, or power systems, or microwave theory.

Canadian Marconi Company Bursary in Electrical Engineering

This bursary, established in 1987 by Canadian Marconi Company, is available to graduate students in Electrical Engineering who are in need of financial assistance.

Application should be made to the Faculty of Graduate Studies and Research and the recipient will be selected each year by the Dean of the Faculty of Graduate Studies and Research.

CHEZ-FM Inc. Research Award in Sociology

This award, valued at $600, was established in 1989 by CHEZ-FM Inc. to assist with the cost of a media-related research project, essay or thesis involving quantitative research on radio broadcasting, broadcast regulation generally, or contributing to general theoretical development in media sociology. It is awarded annually, when merited, to a fourth-year honours student or a graduate student enrolled in a sociology program.

Application is not required. The recipient will be announced by the Dean of the Faculty of Graduate Studies and Research, on the recommendation of a selection committee comprised of the Chair of the Department of Sociology and Anthropology, the Coordinator of Honours Program (Sociology), the Coordinator of Graduate Program (Sociology), and a representative from CHEZ-FM Inc.

R.F. Chinnick Memorial Scholarship

This scholarship is provided by Telesat Canada in memory of R.F. Chinnick, their former vice-President of engineering and operations. It is awarded annually, where appropriate, to a student enrolled in a graduate program in electrical engineering who is working in the field of satellite communications, or whose work has direct relevance to this area of telecommunications.

It is normally awarded in the second or subsequent year of graduate work, when the student's area of specialization has been well established. It may be awarded more than once to the same student, and if an award is not appropriate in a given year, it will be held over so as to allow more than one recipient in a subsequent year.

The Irene Ethel Cockburn Bursary

This bursary, which carries a value of up to $2,000, was established in 1991, and is derived from a legacy of the late Irene Ethel Cockburn. It may be awarded to one or more graduate students who require special financial assistance in order to complete their studies at Carleton University. Application is not required. The recipient(s) will be selected by the Dean of the Faculty of Graduate Studies and Research from a list of candidates recommended by each department.

Scholarship in Comparative Economics

Awarded annually, if merited, on the recommendation of the Chair of the Department of Economics, to a graduate or undergraduate student who has shown aptitude in the field of comparative economics. Endowed in 1991 by Professor Richard Carson in memory of his parents, Robert L. and LeVerne N. Carson.

Davidson Dunton Memorial Student Assistance Fund

Established in 1987 by relatives, colleagues and friends of the late Davidson Dunton, Carleton's fourth and longest serving President and a Director of the School of Canadian Studies, this fund is available to graduate students within the School of Canadian Studies who are experiencing financial difficulty meeting the costs of typing/reproduction of their thesis or other research papers, attendance at conferences, or other approved special needs.

The selection of the recipient(s) will be made upon the recommendation of the Director of the School of Canadian Studies.

The Eastern Branch of the Ontario Association of Professional Social Workers Bursary

Endowed in 1985, this bursary is available to graduate students within the School of Social Work who are nearing the completion of their program and experiencing financial difficulty in meeting the costs of typing/reproduction of their thesis or independent enquiry project.

The selection of the recipient(s) will be decided on the recommendation of the Director of the School of Social Work.

Rachael Elizabeth Edwards Memorial Award

Awarded annually, on the recommendation of the School of Journalism and Communication, to an outstanding student completing the first year of the Master of Journalism program. Preference will be given to a female student who has indicated an interest in pursuing a career in the daily newspaper field.

Endowed 1974 in memory of Rachael Elizabeth Edwards, a former student in the School of Journalism and Communication. Revised 1987.

The Hendrika Alice Eisen Memorial Fund

This fund was established in 1990 by friends, co-workers and relatives of the late Hendrika Alice Eisen, a graduate student in the Department of Psychology who was working in the interdisciplinary area of computer interface design.

In memory of the interdisciplinary nature of her interests and the high regard she had for the annual conference in computer-human interactions (CHI) presented by the Special Interest Group SIGCHI of the Association of Computing Machinery, this fund is to assist graduate students interested in attending this annual conference. Application for assistance with travel or accommodations can be made to the office of the Faculty of Graduate Studies and Research. Preference will be given to students presenting posters or papers at CHI and who are acting as student volunteers at the conference. The award is open to students from any discipline who are interested in attending the CHI conference.

David and Rachel Epstein Foundation Scholarships

Part of the income from the David and Rachel Epstein Foundation Fund, which was established in 1970, has been designated to provide scholarships for outstanding graduate students at Carleton University.

Up to twenty scholarships valued at $1,000 will be awarded annually to students from a list of candidates recommended by each department. Application is not required.

The David and Rachel Epstein Foundation Fellowship: Equal Pay for Work of Equal Value

Established in 1985, this fellowship is open to students studying in any discipline within the social sciences or humanities to support a master's or doctoral student in a thesis program. The thesis should be on the topic of "equal pay for work of equal value", and should have a strong empirical basis with application to Canadian work settings.

Valued at $6,000, this fellowship is provided by part of the income from the David and Rachel Epstein Fund. It will be awarded on the basis of academic merit as determined by the Faculty of Graduate Studies and Research, from a selection of applicants who have submitted a research proposal related to the above. Departments will be asked by the selection committee to nominate suitable candidates. Deadline for the completion is February 1. In a given year, the award may not be made for lack of a suitable candidate.

Harriet and Eugene Forsey Scholarship

This scholarship was established in 1993 by the Canadian Federation of University Women/Ottawa in memory of the mutual fidelity of the Forseys. Senator Eugene Forsey was a recognized expert on the Canadian Constitution and a lecturer in Carleton's Politicial Science Department for many years.

Valued at $1000, this scholarship is awarded annually, when merited, to a graduate student in the Political Science program who is working in the area of the Canadian Constitution. Application is not required. The recipient will be announced by the Dean of the Faculty of Graduate Studies and Research, on the recommendation of the Chair of the Department of Political Science.

GAC-MAC Graduate Scholarship in Earth Sciences

This scholarship was endowed by the Geological Association of Canada and the Mineralogical Association of Canada in recognition of the support provided by the Ottawa-Carleton Geoscience Centre when Carleton University hosted the "Ottawa '86" Annual GAC-MAC Meeting.

It will be awarded annually to a graduate student enrolled in the Ottawa-Carleton Geoscience Centre. Application is not required. The recipient will be selected by the Board of Management of the Ottawa-Carleton Geoscience Centre.

Indira Gandhi Memorial Fellowship

This fellowship, to the value of approximately $10,000, was established in 1985 by friends of India to honour the memory of Mrs. Indira Gandhi, Prime Minister of India, 1966-77, 1980-84.

It is awarded annually to an outstanding (preferably foreign) student enrolled in a graduate program. No application is required for this fellowship. The recipient will be chosen by an awards committee chaired by the Dean of the Faculty of Graduate Studies and Research from candidates recommended by departments, schools and institutes having graduate programs.

Randall Geehan Memorial Scholarship in Quantitative Economics

Awarded annually, on the recommendation of the Chair of the Department of Economics, to a deserving fourth-year honours student or graduate student, whose studies emphasize quantitative work in economics. Endowed in 1990 by colleagues, family and friends in memory of Dr. Randall Geehan who was a professor in the Department of Economics.

Lois Gonyer Bursary

Awarded annually on application on the recommendation of the Director of the School of Canadian Studies to a Canadian studies graduate student whose program is threatened because of financial need. Established in 1988 by friends and colleagues of Lois Gonyer and funded by them and institute graduates in recognition of her twenty-seven years of service as administrator in the School of Canadian Studies.

Graduate Scholarship in Civil Engineering

This award is made possible by contributions from staff and faculty employees in Civil Engineering as well as from other donors. The award, valued at up to $500 will be provided annually to an outstanding undergraduate student at Carleton who enrols in a graduate program in the Department of Civil and Environmental Engineering. No application is required. The recipient will be selected by a scholarship committee composed of the Chair of the Department of Civil and Environmental Engineering, the departmental supervisor of graduate studies, and two other faculty members from the Department of Civil Engineering.

Graduate Student Research Fund

Established in 1989, this fund is intended to cover the modest research costs where other sources of support are not available. Eligible costs are translation, questionnaire production, mailing, field travel, supplies, long-distance telephone, photo-copying costs,etc.

Application is made by letter to the Dean of the Faculty of Graduate Studies and Research outlining the need for the requested fund, and should contain a brief description of the research project

underway, and a research plan. This application should be supported by the student's supervisor.

The Michael Hare Fellowship

The fellowship was endowed in 1988 by colleagues, friends and family in memory of Michael Hare, a graduate of the master's program in geography and former senior proctor in the department.

The fellowship is normally awarded annually to a student in the third or subsequent term of a graduate program in the Department of Geography. It may be held in combination with a teaching or research assistantship. Application is not required; the recipient will be selected by the departmental graduate studies committee. The award is made on the basis of academic achievement combined with a tangible contribution to the quality of the working environment for students in the department.

Neil Huckvale Memorial Scholarship

This award was established in 1981 by family, friends, and colleagues in honour of Neil Huckvale, a former graduate student in the Department of Geography. The recipient will reflect Neil Huckvale's humanity and philosophy, and will be chosen on the basis of merit and special interest in teaching and resource conservation.

The scholarship will normally be awarded annually to a student enrolled in the third or subsequent term of a graduate program in geography. It may be held in combination with a teaching or research assistantship. Application is not required; the recipient will be selected on the recommendation of the graduate studies committee. If an award is not appropriate in a given year, it will be held over so as to allow more than one recipient in a subsequent year.

The Ina Hutchison Award in Human Geography

Established in 1989, the fortieth anniversary of the founding of geography at Carleton, this award is presented annually. Its primary purpose is to assist graduate students in human geography undertake research, but it may also be used to assist graduate students in the preparation of manuscripts for publication and to facilitate conference participation. The recipient(s) will be chosen each year on the recommendation of a Department of Geography selection committee.

International Fee Waiver Scholarships

Carleton University makes available every year a certain number of foreign fee waiver scholarships tenable at the University. These scholarships are made on similar terms to the graduate assistant-ships/ scholarships on entrance to the program. They are for one year at the master's level and two years at the doctoral level. Students will be exempted

from paying the foreign student fees, but will be required to pay the regular domestic fee. It is not necessary to apply separately for this scholarship. Scholarships are contingent on being accepted to a graduate program. The student will be awarded the scholarship on the recommendation of the depart-ment, and will be notified by the Dean of the Faculty of Graduate Studies and Research.

Zbigniew A. Jordan Scholarship

This award, established in 1978 by friends and colleagues in honour of the late Professor Zbigniew A. Jordan, is open to all graduate students in soci-ology.

Application is not required; the recipient will be chosen by the awards committee from candidates recommended by the Department of Sociology and Anthropology on the basis of merit and special interest in sociological theory and the philosophy of social sciences.

The Eve Frankel Kassirer Memorial Scholarship

The Eve Frankel Kassirer Memorial Scholarship is awarded annually, when merited, on the recommendation of the Dean of the Faculty of Graduate Studies and Research, Carleton University, to a graduate student in sociology with research interests relating to ethical issues, the family or allied health professions. It was endowed in 1988 by family and friends in memory of Eve Kassirer.

Eve was one of the first students to receive a master's degree in sociology from Carleton University.

Eldon Kaye Memorial Scholarship

Awarded annually, on the recommendation of the Chair of the Department of French, to an undergraduate or graduate student in the French program who has demonstrated the most promise in French literature. Endowed in 1989 in memory of Eldon Kaye who was a professor in the Department of French.

Sherine Khalil Memorial Bursary in International Affairs

Awarded annually to a deserving full-time student enrolled in the M.A. program in International Affairs who is undertaking work on a thesis related to developmental issues in the Third World, and is in need of financial assistance in order to complete his/her studies. Endowed in 1990 by friends and family of Sherine Khalil, a graduate student in the Norman Paterson School of International Affairs, who died tragically in the summer of 1990.

The recipient will be selected by the Dean of the Faculty of Graduate Studies and Research from a list of possible candidates submitted each year by the Director of the School of International Affairs.

Christoph Lehmann-Halens Memorial Award

Awarded annually, when merited, to a student enrolled in the Master of Journalism degree program at Carleton. While good academic standing is an important consideration, demonstrated interest in the issues of disarmament and/or environmental protection and/or feminist concerns are the main criteria for selection.

The recipient will be chosen each year on the recommendation of the Director of the School of Journalism and Communication.

This award, in memory of Christoph Lehmann-Halens who died tragically in Libya while on assignment, was established in 1987 by his family, friends and Southam News.

The Helen Levine Bursary

This bursary may be awarded to one or two students who require special financial assistance in order to complete their studies in social work. Preference will be given to female students who have demonstrated an interest in pursuing research and practice in women's issues or feminist counselling.

The selection of the recipient will be made upon the recommendation of the Director of the School of Social Work.

Endowed in 1990 in honour of retired Professor Helen Levine, recipient of the Governor General's Persons Award for 1989.

The David Lewis Research Honorarium

Established in 1983 by the David Lewis Trust Fund, this $2,500 research honorarium is awarded annually, when merited, to a graduate student enrolled in the master's program within the Faculties of Social Sciences or Arts. It is to assist the recipient in the preparation of a thesis or research essay dealing with the labour movement and/or democratic socialism in Canada.

Candidates are initially screened by their department, and recommended to the Dean of the Faculty of Graduate Studies and Research. A short list of deserving candidates is submitted to the Board of the David Lewis Trust Fund, the members of which make the final selection of a recipient.

The winner of this honorarium will also receive an additional stipend to assist in the payment of costs associated with the writing and production of the thesis/research essay. This stipend is provided for through an endowment from the BOAG Foundation. A copy of the thesis or research essay is to be sent, upon completion to the BOAG Foundation.

The John Lyndhurst Kingston Memorial Scholarship

This scholarship was endowed in 1984 by Mrs. Leslie Kingston in memory of her late husband John L. Kingston, Architect. It is awarded annually to an outstanding graduate student studying in a discipline within the Faculties of Arts, Social Sciences, Science (including Computer Science) or Engineering, whose work is aimed at the betterment of our society.

Application is not required. The recipient will be selected by the Dean of the Faculty of Graduate Studies and Research from a list of candidates recommended by departmental chairs from the above faculties.

R.O. MacFarlane Memorial Award

This award is presented annually to an outstanding student registered in a graduate program in the School of Public Administration at Carleton University. Endowed in 1971 by relatives, friends, and graduates of Carleton University, the award is named in honour of the late R. Oliver MacFarlane, the first director of the School of Public Administration, 1953-1971.

R.A. MacKay Memorial Fund

This fund was established in 1980 by relatives, friends, and former colleagues of the late R.A. MacKay, a distinguished scholar in Canadian government, a senior member of the Department of External Affairs, professor of political science at Carleton University from 1961, and founding associate director of the Norman Paterson School of International Affairs, 1966-68.

The award is intended to assist graduate students from outside Canada who are studying international affairs at Carleton University; they may be enrolled in the Norman Paterson School of International Affairs or come from a related discipline, such as political science, history, or economics, provided that the "international" component of their course of study is prominent.

Maclean-Hunter Award in Journalism

Value $1,000. Awarded annually, on the recommendation of the School of Journalism and Communication, to an outstanding student proceeding from the first to the second year of the Master of Journalism program.

Donor: Maclean-Hunter Publishing Company Limited. Established 1967. Revised 1987.

The Vic Mallet Scholarship

This scholarship commemorates Vic Mallet, an outstanding student of the Department of English who died tragically in a car accident. Established by the department and by his family and friends, it is awarded annually, when merited, to the student

with the highest academic standing on admission to the master's program. Application is not required; the recipient will be chosen on the recommendation of the Department of English.

The Dewan Chand and Ratna Devi Marwah Memorial Scholarship in Mathematics and Statistics

This scholarship, valued at $1,000, was endowed in 1984 by Professor Kanta Marwah of the Department of Economics in honour and memory of her parents. It will be awarded annually to the most outstanding and deserving graduate student within the Department of Mathematics and Statistics, preferably to a doctoral candidate who, having successfully completed all course and comprehensive requirements, is undertaking completion of a dissertation.

No application is required. The recipient will be selected by the Scholarship Committee, composed of the Chair of the Department of Mathematics and Statistics, the Director of the Ottawa-Carleton Institute of Mathematics and Statics, and Professor Kanta Marwah or her designate. The recipient of the award will be announced by the Dean of the Faculty of Graduate Studies and Research in September each year. In a given year, the award may not be made for lack of a suitable candidate.

P.D. McCormack Fund

The purpose of the fund is to establish a memorial in perpetuity to Peter D. McCormack. The P.D. McCormack Fund is to be used for the support of graduate students in general experimental psychology in the Department of Psychology. Support may be direct (e.g. scholarships) or indirect (e.g. support of a graduate student reading room). The Chair of the Department of Psychology shall determine the deployment of funds on an annual basis.

The P.D. McCormack scholarships should be considered as prestige awards in a manner similar to the Epstein Fellowships. The Dean of the Faculty of Graduate Studies and Research, in collaboration with the Chair of the Department of Psychology, will determine the number and amount of the awards in January of each year to be awarded in the following fall.

The Bruce McFarlane Bursary

In honour of Dr. Bruce McFarlane and in recognition of his outstanding contributions during 33 years as a teacher and a scholar at Carleton University, on the occasion of his retirement in 1992, his friends, colleagues and former students established this bursary. The Bruce McFarlane Bursary is available to full-time graduate students from the Department of Sociology and Anthropology or the Norman Paterson School of International Affairs who need financial assistance in order to meet tuition fees or

cover research costs. Application is not required. The recipient(s) will be selected each year by the Dean of the Faculty of Graduate Studies and Research from candidates recommended by the above units.

Violet McLaughlin Scholarship

This scholarship, which carries a value of up to $1,000, was established in 1984, and is derived from a legacy of the late Violet McLaughlin to graduate students in the School of Social Work.

The scholarship will normally be awarded twice a year to a graduate student who, upon admission, possesses the highest academic standing; and to a student achieving the highest academic standing at the end of the first year of the program.

Application is not required; the recipients will be chosen by the awards committee from candidates recommended by the School of Social Work.

The Stanley Mealing Bursary

Established in 1990 by former students, friends and colleagues of Professor Stanley Mealing on the occasion of his retirement, this bursary is available to full-time master's or Ph.D. students in history who require financial assistance in order to continue their studies at Carleton University.

Applications should be made to the Chair of the Department of History. The selection of the recipient(s) each year will be made upon the recommendation of a selection committee comprised of the Department of History graduate committee.

Chet Mitchell Memorial Award in Law

Established in 1991 by colleagues, family and friends in honour of the late Chet Mitchell, who was a professor in the Department of Law, this award is given annually to a deserving student enrolled in the Master of Arts program in legal studies.

Application is not required. The recipient will be chosen each year on the recommendation of the Chair of the Department of Law.

Roy Buckley Morrison Scholarship

This scholarship was established in 1979 in honour of the late Roy Buckley Morrison by Panasonic/ Matsushita Electric of Canada Limited, and friends and associates. It will normally be awarded to a Canadian citizen or permanent resident of Canada, registered in the Norman Paterson School of International Affairs.

Application is not required; the recipient will be chosen by the awards committee from candidates recommended by the School on the basis of merit and special interest in conflict analysis and/or studies in strategy and security.

George Mulligan Memorial Scholarship

Established in 1989 by colleagues and friends of the late George Mulligan, who was a partner of Toronto Investment Management Inc., this scholarship is awarded annually, when merited, to a deserving student enrolled in the Master of Management Studies program to assist in the undertaking of research for a thesis dealing with investment management.

Application is not required. The recipient will be selected on the recommendation of the Director of the School of Business. In a given year, the award may not be made for lack of a suitable candidate, but will be held over so as to allow more than one recipient in a subsequent year.

Norman Paterson School of International Affairs Alumni Association Foreign Student Bursary

Endowed by the alumni of the Norman Paterson School of International Affairs (NPSIA) in 1990, this bursary is awarded annually to one or more foreign students, admitted full time in the M.A. program in international affairs, who requires financial assistance in order to study at Carleton University.

The recipient will be chosen by a selection committee composed of the Director of the School of International Affairs, two representatives from the NPSIA Alumni Association, and one other faculty member from the School of International Affairs. The name of the recipient will be announced by the Dean of the Faculty of Graduate Studies and Research.

Interested applicants should contact the Director of the School of International Affairs. The bursary may not be awarded if there is no qualified candidate. In such cases it will be held over so as to allow more than one recipient in a subsequent year.

Maureen O'Neil Award in Women's Studies

This award was endowed in 1985 by Canadian Hadassah-WIZO in honour of Maureen O'Neil, Coordinator, Status of Women Canada. It is awarded annually, when merited, to a student enrolled in the Faculty of Graduate Studies and Research who is doing work in the area of women's studies.

Application is not required. The recipient will be selected by the Dean of the Faculty of Graduate Studies and Research from a list of candidates recommended by each department within the Faculties of Arts or Social Sciences.

Robert E. Osborne Award

Awarded annually, on the recommendation of the Chair of the Department of Religion, to an undergraduate or graduate student in the religion program. Preference, in order, will be given in the areas of New Testament, biblical and other forms of religious studies. Endowed 1986 in memory of Robert E. Osborne who was a professor in the Department of Religion.

Khayyam Zev Paltiel Doctoral Dissertation Prize in Social Philosophy, Social Theory or Social Policy

This prize, endowed by Professor Khayyam Z. Paltiel of the Department of Political Science, is intended to provide a fund to assist in the publication of a deserving doctoral dissertation presented to the Faculty of Graduate Studies and Research at Carleton University in the fields of social philosophy, social theory, or social policy. The prize is awarded biennially to the best doctoral dissertation presented in these fields in the previous two-year period. The prize is not intended to be confined to students in a particular discipline; doctoral dissertations in the appropriate fields may be presented in political science, sociology and anthropology, economics, psychology and history. Dissertations are nominated for the prize by the doctoral examining boards; adjudication is by a committee chaired by the Dean of the Faculty of Graduate Studies and Research, and including the appropriate faculty deans together with the chairs of the relevant departments.

Paterson Fellowships

From the generous support provided by the late Senator Norman M. Paterson when the School was established in 1966, funds are allocated to support some candidates for the M.A.degree in the Norman Paterson School of International Affairs.

All those with high standing who are admitted to this program are considered for these fellowships.

Lester B. Pearson Scholarships

These scholarships, which were established in 1990 by a bequest from the estate of the late Lester B. Pearson, will be awarded after the first term of each academic year to three graduate students working in the areas of Canadian foreign policy, politics or history. The awards, having a value of approximately $1,000 each, will be made on the recommendations of the Director of the School of International Affairs and the Chairs of the Departments of Political Science and History.

The Norman Pollock Memorial Award for Latin American Studies

This award is presented annually to an outstanding student in the areas of Canadian-Latin American relations or Latin American development studies. It has been endowed to honour the memory of Norman Pollock by his son, David H. Pollock and his granddaughter Susan A. Harkavy.

Application is not required. The recipient will be selected by the Dean of the Faculty of Graduate Studies and Research from candidates nominated from relevant graduate programs.

John Porter Graduate Bursary

An annual bursary of $1,000 awarded to an M.A. student in sociology who requires financial assistance in order to complete studies at Carleton University. The selection of the recipient will be on recommendation of the Coordinator of Graduate Studies, Department of Sociology and Anthropology.

The John Porter Publication Grant

This grant, established in 1979 by friends and colleagues of the late John Porter, will be awarded annually and is open to authors of book-length works. The applicants must be members of the Carleton University community whose manuscripts have been accepted by a reputable publisher, or persons not affiliated with Carleton University, whose manuscripts have been accepted for publication in the Carleton Library series.

The award, which carries a value of $1,000 (to be applied against the cost of publication of the work), will be made on the basis of overall merit and contribution to the literature dealing with aspects of Canadian society. The recipient will be expected to deliver a public University lecture on the topic of the book, or at near the time of publication.

Applications or nominations should be directed to the grants committee, appointed by the Vice-President (Academic). The committee may decline to make an award in a given year for lack of meritorious candidates.

Rogers Communications Award in Mass Communication

Awarded annually to an outstanding student enrolled in the Master of Arts in Communication program. The recipient will be selected by the awards committee of the Mass Communication Program. Endowed in 1991 by Rogers Ottawa Ltd.

Rogers Communications Award in Television Journalism

Awarded annually on the recommendation of the School of Journalism and Communication to the student graduating from the Master of Journalism who shows the most promise as a television journalist. Endowed in 1991 by Rogers Ottawa Ltd.

The Roderick S.J. Rooney, F.C.A. Memorial Scholarship

This scholarship was endowed in 1985 by Mrs. Isabella M. Rooney in memory of her late husband Roderick S.J. Rooney, F.C.A. It is awarded annually to an outstanding student who is enrolled in the Master of Social Work program.

Application is not required. The selection of the recipient will be decided on the recommendation of the Director of the School of Social Work.

The Dr. Imrich Rosenberg Memorial Award

Awarded annually to a full-time student who is enrolled in a graduate program at Carleton University and is undertaking a research project on Jewish studies. Need, integrity, and all-round contribution to the study of the philosophical and practical intricacies of the Jewish people/nation in the world will also be criteria used in the selection of the recipient each year. Endowed in 1991.

Application is not required. The recipient will be chosen on the recommendation of a selection committee chaired by the Dean of the Faculty of Graduate Studies and Research, from a list of candidates nominated by departments, schools and institutes having graduate programs.

William and Margaret Roxburgh Memorial Award

This award was established in 1981 by Gwenda and Ross Roxburgh, and is open to all graduate students in the School of Canadian Studies. The amount of $250 is provided annually to assist students in carrying out research projects.

Application should be made to the Director of the School of Canadian Studies; recipients will be chosen from a list of candidates recommended by the Director.

John Ruptash Memorial Fellowship

This fellowship was established in 1974 by relatives, former students, faculty colleagues and friends as a memorial to the late John Ruptash, who was Dean of the Faculty of Engineering and later Dean of the Faculty of Graduate Studies from 1959 to 1973. The fellowship has been awarded annually, beginning in 1975-76, to an outstanding graduate student in the Faculty of Engineering; it may be held in combination with a teaching or research assistantship.

Application is not required; the recipient will be chosen by the awards committee from candidates recommended by the Faculty of Engineering.

The Arnold Smith Commonwealth Scholarship

This scholarship will be awarded annually from funds provided by the Royal Commonwealth Society, Ottawa Branch, to a student from a Commonwealth country other than Canada in any field of study at the graduate level. The award will be based on academic excellence and seeks to recognize students who will use their studies to contribute to the development of their country of origin.

Application is not required. The recipient will be chosen by the awards committee of the Faculty of Graduate Studies and Research from a list of candidates recommended by each department.

The Arnold Smith Award in International Affairs
Valued at $1,500, this award was established in 1990 by the North-South Institute in honour of the outstanding contribution made to the Institute by its Chair of the Board, Mr. Arnold Smith. It is awarded annually, when merited, to a student who is enrolled full-time in the Master of Arts program in international affairs, is following the development studies core, and whose work focuses on Canadian policies toward developing countries in aid, trade or international finance. Application is not required. The recipient will be selected each year by the Dean of the Faculty of Graduate Studies and Research on the recommendation of the Director of the School of International Affairs.

Social Sciences Graduate Bursary
This fund is made possible by contributions from staff and faculty employees in the social sciences. Support of up to $100 is available to graduate students nearing the completion of program and experiencing financial difficulty in meeting the costs of typing/ reproduction of an M.A. or Ph.D. thesis.

Application should be made to the chair/director of the student's department, for referral with recommendation to the Dean of Social Sciences.

Staff and Faculty Prize in Development Administration
Established in 1985 from the generous support provided by the staff and faculty of the School of Public Administration, this award is presented annually to an outstanding student proceeding from the first to the second year of the development administration stream in the School of Public Administration. The recipient will be chosen by the awards committee of the Faculty of Graduate Studies and Research from candidates recommended by the School of Public Administration.

Stentor Environmental Research Scholarship
Established in 1991 by Stentor Canadian Network Management, on the occasion of its sixtieth anniversary, this scholarship valued at $2,500 is awarded annually, when merited, to a student enrolled in any graduate program at Carleton University who is undertaking research on an environment-related issue.

Application is not required. The recipient will be chosen by an awards committee chaired by the Dean of the Faculty of Graduate Studies and Research

from candidates recommended by departments, schools and institutes having graduate programs.

The Frank Stone Memorial Prize
Awarded annually, when merited, to a student graduating from the M.A. program in international affairs who presents the best thesis or research essay on Canadian trade policy. Endowed in 1990 by friends and colleagues of the late Frank Stone in honour of his contribution to the study of trade policy in Canada and to encourage others to follow in his footsteps.

Application is not required. The selection of the recipient will be decided on the recommendation of the Director of the School of International Affairs and the winner will be announced each year by the Dean of the Faculty of Graduate Studies and Research.

Michael Thompson Scholarship in English
Awarded annually, on the recommendation of the Chair of the Department of English Language and Literature, to the English Honours student with the highest grade point average who is proceeding from third to fourth year of the Honours program, or from fourth year to Carleton's Master of Arts program in English. Endowed in 1992 by colleagues, friends and former students in honour of Professor Michael Thompson's many contributions to the Department and to the University.

Philip E. Uren Fellowships
Two fellowships are awarded annually, one to a graduate student in the Department of Geography and one to a graduate student in the Norman Paterson School of International Affairs; and may be held in combination with a teaching or research assistantship. Application is not required; the recipient will be chosen by the Dean of the Faculty of Graduate Studies and Research on the recommendation of the awards committees from the academic units involved. The fellowships were established in 1980 by relatives, friends, former students, and faculty and staff colleagues as a memorial to the late Philip Ernest Uren who was a professor of geography between 1965 and 1979, and who served the University as Chair of the Department of Geography, Director of the Institute of Soviet and East European Studies, Director of the Norman Paterson School of International Affairs, and Director of the Paterson Centre for International Programs.

Johan Van Beek Memorial Bursary
Valued at approximately $1,500, this bursary is awarded annually to a student from a developing country, enrolled in the M.A. program in international affairs, whose particular area of study is

international development and who is in need of financial assistance.

The recipient will be selected by the Dean of the Faculty of Graduate Studies and Research, from a list of possible candidates submitted each year by the Director of the School of International Affairs. If there is more than one deserving candidate in any given year, this bursary may be split between them.

The Varian Graduate Scholarship in Analytical/Environmental Chemistry

This Scholarship was established in 1992 by Varian Canada in recognition of its involvement in the development of the Centre for Analytical and Environmental Chemistry, in the Department of Chemistry. Valued at $2,000, this scholarship is awarded annually to an outstanding graduate student who is carrying out research in the Centre for Analytical and Environmental Chemistry. Application is not required; the recipient will be announced by the Dean of the Faculty of Graduate Studies and Research based on recommendation from the Department of Chemistry.

Charlotte Whitton Fellowships in Canadian Urban Life

In honour of the distinguished contribution of the late Charlotte Whitton to Canadian urban life and politics, and her long association with Ottawa, up to two fellowships in urban life will be awarded annually to the student(s) in the School of Canadian Studies with the highest standing on admission. The proposed field(s) of study must relate to urban life and problems.

The recipient(s) will be chosen by the Dean of the Faculty of Graduate Studies and Research on the advice of the Director of the School of Canadian Studies.

The S.F. Wise Graduate Scholarship

This scholarship, established in 1990 by members of the Carleton community to honour a former Dean of the Faculty of Graduate Studies and Research, will be awarded annually to a doctoral student who has demonstrated research potential through publication.

Application is not required. The recipient will be chosen each year by the Dean of the Faculty of Graduate Studies and Research from a list of candidates recommended by departmental chairs and directors.

The Monty Wood Fellowship in Tropical Environmental Conservation

Established in 1993 by the Faculty of Graduate Studies and Research, this fellowship recognizes and complements the substantial contribution made by Dr. Monty Wood, Adjunct Professor of Biology.

This award, valued at $1,200, will cover costs of travel and operating expenses for field research in environmental sciences or systematics of tropical ecosystems, preferably in the Americas. Applicants must have demonstrated ability in and commitment to biological conservation through volunteer work, publications, thesis topic, etc., and to passing on knowledge of ecological systems and their conservation. Demonstrated ability to conduct field studies is required.

Applications should be made to the departmental Chair, who will make a recommendation to the Dean of the Faculty of Graduate Studies and Research. They should include a project proposal with an objective that will result in publication of the research results.

YTV Canada Inc. Youth and Television Award

Established in 1992 by YTV Canada Inc., this scholarship valued at $1,500 is awarded annually to a student enrolled in the Master of Arts program in Communication, whose these topic is related to youth and television. Application is not required. The selection of the recipient will be made upon the recommendation of the School of Journalism and Communication to the Dean of the Faculty of Graduate Studies and Research.

David and Rebecca Zelikovitz Scholarships

Endowed in 1991 through a bequest from the estate of the late David Zelikovitz, this scholarship is awarded annually to a deserving graduate student who is studying Jewish culture.

Application is not required. The recipient will be selected by the Dean of the Faculty of Graduate Studies and Research from among those candidates recommended each year by departments, schools and institutes having graduate programs.

Graduate Bursaries

A full-time graduate student who experiences *unexpected* financial need, after completion of five weeks from the date of most recent registration, may be awarded a bursary of up to $1,000 for the year. Application forms are available from the office of the Faculty of Graduate Studies and Research.

Residence Fellowships

Applications are invited from graduate and senior undergraduate students with good academic standing. The Residence Fellowship responsibilities include supervision of a floor in residence, enforcement of community regulations and counselling of students in residence. An excess of twenty hours per week is required to meet job responsibilities satisfactorily. Please note that the selection process demands that

candidates attend an interview and a workshop in second term.

Application forms may be obtained from the office of Student Housing and Food Services, Carleton University, 1125 Colonel By Drive, Ottawa, Ontario, K1S 5B6. Deadline for receipt of application is January 15.

Special Bursary for Students in Social Work

This bursary, in the amount of $1,000 annually, may be awarded to one, or divided between two students in the School of Social Work who require special financial assistance in order to complete their studies at Carleton University. The selection of the recipient(s) will be decided on the recommendation of the Director of the School of Social Work.

Awards Tenable at Carleton University

Canada Mortgage and Housing Corporation Scholarships

The Canada Mortgage and Housing Corporation offers graduate scholarships for full-time study in various fields related to housing in its urban and regional context.

This competition is open only to Canadian citizens or landed immigrants who wish to study the social, physical, environmental, economic, legislative, or administrative aspects of housing. The value of CMHC University Scholarship is $13,200, which is to cover all expenses, including tuition fees. The scholarship is tenable at a Canadian University only.

Application forms and additional information can be obtained from the office of the Faculty of Graduate Studies and Research.

Commonwealth Scholarships and Fellowships

The Government of Canada, through the Commonwealth Scholarships and Fellowships Committee, offers annually a number of scholarships and fellowships, normally tenable for two years, which cover such expenses as travelling costs, tuition fees, other University fees, and a living allowance, to students of other Commonwealth countries.

Under a plan drawn up at a conference held in Oxford in 1959, these scholarships and fellowships are awarded mainly for graduate study, and are tenable in the country making the offer.

Students are advised to consult the office of the Faculty of Graduate Studies and Research. The deadline for receipt of applications is October 31, for all awarding countries except Australia and New Zealand. The deadline for receipt of applications for Australia and New Zealand awards is December 31.

For further details, please contact the Canadian Bureau for International Education, 85 Albert Street, Suite 1400, Ottawa, Ontario, K1P 6A4. Application forms are available from Carleton International, Room 1506 Dunton Tower, Carleton University.

I.O.D.E. War Memorial Scholarships

Nine scholarships are offered annually by the Imperial Order Daughters of the Empire for postgraduate study and research in the humanities or social science. The awards are valued at $12,000 for study in Britain or another country in the Commonwealth, and $8,500 for study in a Canadian University.

Candidates must be Canadian citizens and graduates of recognized colleges or universities.

Application forms are available from the office of the Faculty of Graduate Studies and Research. Deadline is December 1.

Sir John A.Macdonald Graduate Fellowship in Canadian History

The Province of Ontario annually offers the Sir John A. Macdonald Graduate Fellowship, valued at $8,500, for full-time graduate studies and research in the field of Canadian history at the Ph.D. level. The fellowship is tenable for three years, at an Ontario University only, and it will be awarded to a Canadian citizen resident in Ontario.

Application forms and additional information can be obtained from the Graduate Studies and Research office. The deadline date for submission of completed applications to the Dean of the Faculty of Graduate Studies and Research is March 1.

Department of National Defence Scholarships and Fellowships

The Department of National Defence offers scholarships and fellowships for strategic studies of relevance to current and future Canadian national security problems, including their political, economic, social, and military dimensions. Eight Ph.D. scholarships valued at up to $12,000 and eight M.A. scholarships valued at up to $10,000 will be awarded to cover tuition fees and related expenses.

Applicants must be Canadian citizens. Deadline is February 1.

Natural Sciences and Engineering Research Council

NSERC Postgraduate Scholarships (range $15,600 – $17,400) are tenable at Carleton University by students undertaking advanced studies and research in science, engineering, experimental psychology, and physical geography.

Students currently enrolled at Carleton University must apply through their departments on prescribed

forms available from the office of the Faculty of Graduate Studies and Research. Departments will advise students of relevant deadlines.

1967 Science Scholarships

NSERC annually offers 1967 Science Scholarships, valued at $20,500 for twelve months, plus a travel grant.

The University selection committee will determine which, if any, of the candidates for postgraduate scholarships (for a first year of graduate studies) are sufficiently outstanding to be nominated for a 1967 Science Scholarship.

Applications (including supporting documents) must be sent to the office of the Faculty of Graduate Studies and Research by November 1.

These awards are tenable in any Canadian University other than the one from which the candidate expects to receive his/her bachelor's degree.

Noranda Bradfield Graduate Fellowships Program

The Noranda Bradfield Graduate Fellowships are given to promote and encourage research collaboration between Canadian universities and companies in or associated with the Noranda Group. Up to seven fellowships, each valued at $15,500, are available to full-time students in graduate programs leading towards a master's or doctoral degree working in the natural and applied science, mathematics, economics, business and commerce.

Application should be made through the appropriate University department to the Secretary, The Noranda Bradfield Graduate Fellowship Program, Noranda Research Centre, 240 Hymus Boulevard, Pointe Claire, Quebec, H9R 1G5 not later than March 1.

Ontario Graduate Scholarships

The Province of Ontario annually offers scholarships of $3,953 per term to students who intend to pursue graduate studies at an Ontario University. Applicants must have maintained an overall average of at least A– or the equivalent, during each of the last two years of study at the postsecondary level.

Application forms and brochures containing details of the award may be obtained from the office of the Faculty of Graduate Studies and Research. Registered students should submit completed application forms to their department. The department will advise students of the relevant deadlines.

The Queen Elizabeth II Ontario Scholarships

The Queen Elizabeth II Ontario Scholarship Fund provides a number of annual awards in the fields of humanities, social sciences, and mathematics, for

candidates expecting to be in the final year of their Ph.D. research and writing during their tenure of the award.

These scholarships, valued at $13,000, plus a general expense allowance of $500, are open only to Canadian citizens and landed immigrants, and are tenable only at Ontario universities. Preference will be given to candidates who are residents of Ontario.

Prescribed application forms are to be completed and submitted to the Dean of the Faculty of Graduate Studies and Research by December 1, for transmission to the selection committee by December 15.

J.H. Stewart Reid Memorial Fellowship

This fellowship provides an award of $5,000 for twelve months for any field of study in a graduate program in any Canadian University. It is open to students who are Canadian citizens, or who have held landed immigrant status from April 30 and have been admitted to a Canadian graduate program by the time of award. Applications may be obtained from the Awards Officer, Canadian Association of University Teachers, 294 Albert Street, Suite 308, Ottawa, Ontario. K1P 6E6.

Social Sciences and Humanities Research Council of Canada

The Council offers fellowships ranging in value up to $14,436 for studies and research at the doctoral level in the humanities and social sciences.

These fellowships are tenable in Canada or abroad for a maximum of twelve months and may be renewed upon application.

Application forms and brochures containing details of the assistance programs available may be obtained from the office of the Faculty of Graduate Studies and Research, or by writing to the Council, P.O. Box 1610, Ottawa, Ontario, K1P 6G4. Departments will advise students of the deadline.

Queen's Fellowships

Two or three Queen's Fellowships will be awarded annually to the most highly-ranked Doctoral Fellowship recipients entering the first year of a doctoral program in Canadian Studies. The fellowships are tenable only at a Canadian University and will provide tuition and travel costs in addition to the basic Doctoral Fellowship award.

Joint Initiative: SSHRC/FCAR/NSERC

Doctoral fellowships offered under the SSHRC/ FCAR/ NSERC Joint Initiative program are intended to encourage students to change their linguistic milieu and their place of study from Quebec to another province and vice versa. Applicants must submit an application to the SSHRC's regular Doctoral Fellowships program and be successful

in the completion. The proposed program of study and the University of affiliation must involve a move from a University outside Quebec to a University within Quebec and vice versa as well as a change in the language of study from that of the undergraduate program. In addition to the Council award, successful applicants will be awarded a supplement of $4,000 per year by the Fonds FCAR, renewable for as long as they are holders of a SSHRC Doctoral Fellowship.

Tuition fees in excess of $600 will also be paid by the Fonds FCAR.

Government Aid Programs

Ontario Residents

Canadian citizens or landed immigrants (permanent residents) who are residents of Ontario may qualify for assistance form the Ontario Student Assistance Program. The financial aid scheme is designed to supplement, rather than replace, family and/or student resources. In order to determine the additional funds required, the province objectively assesses the resources that could reasonably be used to provide for the student's educational costs. Interest free Canada Student Loans and/or Ontario student Loans are given to assist the student. The maximum loan a student can receive in one academic year is usually the total amount of his or her allowable educational costs. Application forms and further information can be obtained by contacting the Awards office at Carleton or the Student Awards Branch of the Ministry of Education and Training, Fellowship Section, P.O. Box 4500, 189 Red River Road, 4th Floor, Thunder Bay, Ontario, P7B 6G9.

Students wishing to have applications processed in time for fall registration must ensure that completed forms are submitted to the Awards office by July 1.

Residents of Other Provinces/Territories Except Quebec

Canadian citizens or landed immigrants (permanent residents) from the territories and all other provinces except Quebec may qualify for assistance from the Canadian Student Loans Plan through their home province. The loan is interest free while the student is enrolled full time. Some provinces also make available non-repayable grant assistance along with this federal loan.

The Awards office disburses general information on the various provincial aid schemes but application forms and details on individual programs must be obtained from the authorities in the home province. Deadline dates vary but, generally speaking, it is wise to apply for financial assistance through the appropriate provincial department before June 30.

Quebec Aid

Applications from students for assistance from the province of Quebec should be made directly to the Awards office. Deadline dates for submission of applications are May 31 for all students who submitted an application for the previous school year and June 30 for all students who did not submit an application for the previous school year. In order to be accepted by the Department of Education, all applications must be coded by the Awards office.

The above government assistance programs are subject to change.

University Loan Funds

John Parker Loan Fund

This fund was established to provide loans of up to $1,000 to students in their first year of studies at Carleton University, and up to $1,500 in future years to students who require financial assitance to meet their educational costs. This fund also provides emergency loans for 60 days or less to students whose funds from other sources have been delayed. Application forms are available to students in the Awards Office, Room 202, Robertson Hall, telephone 788-3600.

FACULTY OF ARTS

Dean G.S. Adam

Program Descriptions

and

Details of Courses

School for Studies in Art and Culture
Art History

Dunton Tower 2201
Telephone: 788-2342
Fax: 788-3575

The School
St. Patrick's Building 427

Director:
John Shepherd
Supervisor of Graduate Studies:
Ruth Phillips

The School for Studies in Art and Culture offers a program of study and research leading to the degree of Master of Arts in Canadian Art History. The program is unique in its breadth and comprehensiveness. Students can choose to focus on art and architecture drawn from Canada's wealth of different artistic communities including the traditions of Euro-Canadians, aboriginal peoples, other ethnic groups, and women. They are encouraged to consider these traditions as aesthetic expressions and within broad contexts of race and gender and of social, political and economic history.

Qualifying-Year Program
Applicants who do not qualify for direct admission to the master's program may be admitted to a qualifying-year program. Applicants who lack an honours degree, but have a pass degree with an honours standing (at least B overall) will normally be admitted to a qualifying-year program. The regulations governing the qualifying-year are outlined in the general section of this calendar, page 16.

Master of Arts

Admission Requirements
The minimum requirement for admission to the master's program is an honours bachelor's degree (or the equivalent) in art history or a related discipline, with at least high honours standing. Related disciplines may include anthropology, Canadian history, and Canadian studies. Applicants without a background in art history may be required to take up to a maximum of two full credits in certain designated courses from the undergraduate art history program in addition to their regular program.

Program Requirements
The specific program requirements for students in the M.A. program are as follows:
* Art History 11.500: The Practice of Canadian Art (one full credit)
* Art History 11:599: M.A. Thesis (two full credits)
* Four half-credit courses, with a minimum of two and no more than three to be taken from the following six areas of concentration in Canadian art: Euro-American tradition, Indian art, Inuit art, architecture, photography, folk and popular arts

One half-credit may (subject to the approval of the graduate supervisor) be taken outside the Art History program. A maximum of one full-course (or the equivalent) may be selected from Art History offerings at the 400-level.

The student's program will be developed in consultation with the graduate supervisor and graduate faculty of Art History, and must be approved by the graduate supervisor. The prescribed program will take into account the student's background and special interests, as well as the research strengths of the Art History graduate faculty.

Deadlines
Thesis Proposal: Full-time students will normally submit their thesis topic to the thesis proposal board no later than the middle of the second term of registration for students enrolled full-time and no later than the middle of the fifth term of registration for students enrolled part-time.

Thesis: A candidate will inform the thesis supervisor two weeks in advance of the date on which the thesis will be submitted. The date of the defence will be set upon submission of the thesis. The defence will take place no sooner than two weeks after the date of submission; therefore, there will be a minimum of four weeks between the candidate's statement of intent and the defence.

Language Requirements
The student will be required to demonstrate a reading knowledge of French (or another language to be approved by the Art History graduate supervisor).

Academic Standing
A standing of B– or better must be obtained in each course counted towards the master's degree.

Graduate Courses*

• Art History 11.500T2
The Practice of Canadian Art History
This course will examine three areas: (1) the historiography of both native and non-native Canadian art history; (2) the history and practice of collecting institutions in the six areas of concentration in Canadian art: Indian art, Inuit art, Canadian art: Euro-American tradition, architecture, folk and popular arts, and photography with attention to questions posed by new methodologies and theoretical approaches; and (3) cross-cultural and multi-cultural aspects of contemporary art. Additionally, it will provide on-site introduction to techniques of archival and collection research within the major collecting institutions in Ottawa.

• Art History 11.501F1, W1 or S1
Graduate Practicum
This course will involve practical on-site work in Ottawa collecting institutions (as available) and an extensive written assignment derived from the practicum project. The departmental graduate practicum coordinator and the on-site supervisor will be jointly responsible for the final mark. A maximum of one full-credit practicum will be accepted towards degree requirements.

• Art History 11.502F1, W1 or S1
Directed Readings and Research
Tutorials designed to permit students to pursue topics in Canadian art which they have selected in consultation with the faculty of the program.

• Art History 11.512F1
The History of Art Criticism in Canada to 1940
Critical reaction to art exhibitions held by organizations such as the Ontario Society of Artists, the Art Association of Montreal, and the Royal Canadian Academy, among others, will be examined in order to establish the climate of public opinion, the pattern of critical methodology, and the assumptions implicit in contemporary aesthetic ideas at various periods in the development of Canadian art. Preferences for certain types of subject matter, stylistic approaches, compositional formats, and scale will also be considered, as will the effect of criticism upon the artists' work.

• Art History 11.560W1
Canadian Folk and Popular Arts: Sources and Styles
This course will examine regional and community-based artistic traditions, particularly those involving immigrants to Canada from Europe and other parts of the world. It will survey sources and styles with particular emphasis on the social context of artistic practice and appreciation.

• Art History 11.599F4, W4 or S4
Thesis

Courses Not Offered 1994-1995

11.511	Topics in Historical Canadian Art
11.513	Esotericism in Canadian Art
11.515	Reading Modernism and Post-Modernism in Canada
11.516	Contemporary Women Artists: 1970 to the Present: Vision and Difference
11.517	Public Art in Canada: Issues and Realities
11.518	Contemporary Canadian Earthworks and Environmental Art
11.520	Art of the Woodlands Indians in the Historic Period
11.521	Art of the Plains Indians in the Historic Period
11.522	Art of the North-West Coast Indians in the Historic Period
11.523	Museums and First Nations in Canada
11.524	Contemporary Indian Art
11.526	Canadian Art and the Museum
11.527	Creating an Exhibition
11.530	Prehistoric and Historic Inuit Art
11.531	Contemporary Inuit Sculpture
11.532	Contemporary Inuit Graphic Arts
11.533	Topics in Contemporary Inuit Art
11.540	Aspects of Historical Architecture in Canada
11.542	Architectural Drawings in Canadian Collections
11.543	Contemporary Canadian Architecture
11.550	Historical Canadian Photography
11.551	Modern Canadian Photography
11.561	Canadian Folk and Popular Arts: Critical Readings

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* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

School of Canadian Studies

Dunton Tower 1108
Telephone: 788-2366
Fax: 788-3903

The School

Director of the School:
Stan McMullin
Associate Director:
To be announced
Graduate Supervisor and Coordinator, Canadian Women's Studies:
Katherine Arnup
Coordinator, Northern and Native Studies:
Simon Brascoupé
Coordinator, Cultural Studies:
Stan McMullin
Coordinator, Heritage Conservation:
Julian Smith
Coordinator, Advanced Summer School:
Stan McMullin
Professor of Political Science and Canadian Studies:
J.M. Vickers
Associate Professor of English:
Parker Duchemin
Associate Professor of Law:
M.H. Davies
Adjunct Research Professors:
R.T. Clippingdale, C.D. Ellis, Heather Menzies, James Page, Patricia Whitney
University Visitor:
John Fraser
Fellows:
Blair Neatby, Gordon Robertson

The School of Canadian Studies offers a program of study and research leading to the degree of Master of Arts in Canadian Studies.

The work of the School is conducted with the assistance of faculty and availability of coursework in a variety of supporting departments including: Architecture, Art History, Economics, English, Film Studies, French, Geography, History, Journalism and Communication, Law, Linguistics and Applied Language Studies, Music, Political Science, Psychology, Public Administration, Religion, Social Work, Sociology and Anthropology, and Women's Studies.

The Canadian Studies program is interdisciplinary in emphasis. It enables students in the School to develop individual areas of concentration to meet particular interests in a broad range of Canadian issues.

The proximity of Carleton University to the National Library, the National Gallery of Canada, the national museums, the Library of Parliament, the Public Archives of Canada, Statistics Canada, and the libraries of various government departments and embassies, ensures excellent research facilities for graduate candidates in Canadian Studies.

With the aid of a grant from the Donner Foundation, the School has initiated a program area of Northern and Native studies. The same conditions and requirements apply as in other program areas; however, special consideration may be given to candidates for admission who have extensive knowledge of the north or of native peoples, and the language requirement may be met by a demonstrated knowledge of an aboriginal Canadian language in addition to English or French.

In 1983-84, a program area of women's studies was instituted. Both interdisciplinary and comparative in focus, the program permits students to examine the interplay within the Canadian context between gender and race, gender and nationality, gender and class, and sex/gender as a dynamic principle in the process of imperialism, nation building, and the construction of national and ethnic identities.

Since 1986, the School has offered a program area in Canadian culture and cultural policy. Students with a broad interest in traditional and popular culture, music, art, film, literature and performing arts will find the program's interdisciplinary approach to cultural theory and practice of value.

A program area in heritage conservation began in 1989-90. With an interdisciplinary focus on the Canadian built environment, the program permits the course of study to be tailored to individual interest and backgrounds. The Department of Leisure Studies at Ottawa University, the Heritage Canada Foundation, and the Canadian Parks Service at Environment Canada cooperate in offering the program.

The School also runs an advanced summer program from mid-May to mid-August. The format includes credit and non-credit courses, seminars, and public events. Write to the School of Canadian Studies for information about summer 1994.

Qualifying-Year Program

Applicants with general (pass) bachelor's degrees with second-class standing will be required to complete a qualifying year of study with at least high honours standing before proceeding to the master's program.

Refer to the general section of this calendar for the regulations governing the qualifying year.

Master of Arts

Admission Requirements

Applicants must normally hold an honours B.A. (or the equivalent), with at least high honours standing, in one of the disciplines represented in the School. *Applicants wishing to be considered for financial assistance from Carleton University are advised to submit completed applications to the School by February 1st as enrolment in the School is limited.*

Language Requirement

The School requires a reading knowledge of French from its students. This requirement may be met in one of two ways:

• Successful completion of a 100-level French course or its equivalent, preferably French 20.106

• Successful completion of a language examination The School conducts the language examinations in September and January. Students choosing the first option should note that examination results in these courses form part of their record, although they are additional to the course requirements for the degree.

Program Requirements

The minimum requirements for the master's program are outlined in the general section of this calendar. The School of Canadian Studies specifies that all candidates must select one of the following program patterns:

• Three full courses or the equivalent, a thesis, and an oral examination

• Four full courses or the equivalent, and a research essay

• Five full courses or the equivalent, and a comprehensive examination in two parts; part one based on 12.501, and part two based on one of 12.510, 12.520, 12.530, or 12.540

Comprehensive Examinations

A committee will be assigned on entrance to each candidate choosing the five course option to advise and assist in the preparation for the comprehensive examinations. The comprehensive examination will normally be written but may, with the approval of the Graduate Supervisor be oral. The comprehensive

examination will normally be undertaken in the academic year in which the student completes 12.501, but with the approval of the Graduate Supervisor, may be undertaken at a later point in the student's program. Whichever pattern is selected, all School students are required to take 12.501 and one of 12.510, 12.520, 12.530 or 12.540. *Thesis/Research Essay Proposal*
Students are required to file with the School a detailed proposal of their thesis or research essay project no later than the end of the second term of registration for students enrolled full time and no later than the end of the fifth term of registration for students enrolled part time. Students failing to file a proposal may not be permitted to register in subsequent terms until this requirement has been met. Approval of proposals shall be the responsibility of the student's intended thesis/research essay supervisor, the Graduate Supervisor of the School and the program area coordinator. *Special Requirements for Heritage Conservation Program Area*
Students are expected to have some knowledge of the history of Canadian architecture. This requirement may be met by successful completion of 76.302, History of Canadian Architecture, or its equivalent either before or after admission. This course is in addition to the requirements for the degree.

• Architecture 77.541F1,W1 and 78.542F1,W1

Graduate Courses*

Students not registered in the M.A. program in the School of Canadian Studies may take interdisciplinary seminars with the permission of the School.

• Canadian Studies 12.501F1,W1 or S1
Modern Concepts of Canada
Interdisciplinary Seminar. Topic varies from year to year. Meets twice weekly in the summer terms. *Prerequisite:* Graduate standing in the School.

• Canadian Studies 12.502F1, W1, or S1
Interdisciplinary Methods
A survey of the issues raised by problem-directed methodologies; critiques of existing methodology including from the standpoints of feminist and native scholarship. *Prerequisite:* Canadian Studies 12.501.

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* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• Canadian Studies 12.503F1, W1, S1
Selected Topics in Canadian Studies
Topic varies from year to year.

• Canadian Studies 12.510T2
Northern and Native Issues
Interdisciplinary seminar. The significance of the north to Canada, and the position of native people in Canadian society. The impact of resource development and modern technology on both the north and native people.

• Canadian Studies 12.520T2
Women's Studies
Interdisciplinary seminar. The significance in the Canadian experience of sex/gender in the dynamics of imperialism, nation building, class differentiation, and the construction of culture, Canadian feminist theory and the history of women's movements.

• Canadian Studies 12.530T2
Canadian Culture and Cultural Policy
Interdisciplinary seminar. The nature of Canadian culture and purposes, activities and impact of the principal Canadian institutions, agencies and systems involved with cultural production, in both English- and French-language dimensions.

• Canadian Studies 12.540T2
Canadian Heritage Conservation
An interdisciplinary seminar providing an introduction to the cultural, economic, legal, political and technical aspects of the conservation of heritage resources. Particular attention will be given to the elements of the built environment, buildings, complexes, landscapes, and urban areas, along with their associated artifacts.

• Canadian Studies
Internship/Practicum
A limited number of internships and practicum placements are available each year in institutional settings outside of the University. Students are required to complete a formal written paper, in addition to their internship/practicum activities. The written work is evaluated jointly by the student's internal and external advisers.

12.580T2	Internship/Practicum
12.581F1, S1	Internship/Practicum
12.582W1, S1	Internship/Practicum

Students are advised to apply to the Graduate Supervisor no later than a month prior to the beginning of the term in which placement is desired.

• Canadian Studies 12.590T2, S2
Directed Studies
Reading and research tutorials. A program of supervised reading and preparation of written work in an area not covered by an existing graduate seminar.

• Canadian Studies 12.591F1, W1, S1
Directed Studies
Reading and research tutorials. (Same description as 12.590.)

• Canadian Studies 12.592T2, S2
Directed Studies
Reading and research tutorials. (Same description as 12.590.)

• Canadian Studies 12.593F1, W1, S1
Directed Studies
Reading and research tutorials. (Same description as 12.590.)

• Canadian Studies 12.598F2, W2, S2
Research Essay

• Canadian Studies 12.599F4, W4, S4
M.A. Thesis

Selection of Courses

In addition to the graduate courses offered by the School, the following courses are of particular relevance to students in Canadian Studies. The list is not exclusive and is subject to change. Master's students in the School must complete at least four courses, or the equivalent, at the 500 level, with the possibility of one course at the 400 level.

Note: *Students should be aware that the number of spaces in graduate courses offered by other departments may be limited, and that registration may be conditional upon obtaining the prior approval of the department concerned. It is the responsibility of the student to ensure that permission is obtained from the appropriate department prior to registering in any of the department's courses.*

Anthropology

54.470	Selected Problems in the Study of North American Native Peoples
54.516	North American Native Studies
54.517	Problems in North American Ethnohistory
54.538	Feminist Analyses

Architecture

76.423	Society and Shelter
76.425	Workshop: User Analysis and Building Performance
76.500	Directed Studies in History and Theory of Architecture
76.501	Directed Studies in Architecture and Society
77.440	Design for Construction
77.441	Workshop: Technical Studies in Heritage Conservation

78.500	Directed Studies in Architecture and the City
78.542	Workshop: Urban Studies in Heritage Conservation
79.500	Directed Studies in Computer-Aided Design

Art History

11.400	Topics in Canadian Art: Historical Canadian Portraiture
11.404	Inuit Sculpture
11.405	Historic Woodlands Art
11.461	Topics in Twentieth-Century Art: Contemporary Earthworks and Environmental Art
11.490	Directed Readings and Research
11.491	Directed Readings and Research
11.492	Directed Readings and Research
11.500	The Practice of Canadian Art History
11.501	Graduate Practicum
11.502	Directed Readings and Research
11.514	Canadian Women Artists: Between the World Wars
11.520	Art of the Woodlands Indians in the Historic Period
11.541	Canadian Architecture 1867-1967: Themes and Approaches

Comparative Literary Studies

17.401	Foundations of Comparative Literary Studies
17.402	Theories of Literature
17.501	Problems in the Theory of Literature I
17.502	Problems in the Theory of Literature II
17.522	Literary History III

Economics

43.435	Employment Economics and Labour Policy
43.465	Industrial Relations
43.480	Urban Economics
43.511	Canadian Economy I
43.512	Canadian Economy II
43.531	Firms and Markets
43.532	Competition Policy
43.533	Regulation and Public Enterprise
43.541	Public Economics: Expenditure
43.542	Public Economics: Taxation
43.581	Regional Economics
43.582	Urban Economics

English Language and Literature

18.481	Selected Topics in Canadian Poetry
18.483	Studies in the Literature of Quebec and English Canada
18.486	Studies in Canadian Literature I
18.487	Studies in Canadian Literature II
18.581	Canadian Poetry
18.582	Ethnicity, Multiculturalism and Canadian Literature
18.583	Canadian Fiction
18.587	Selected Topic in Canadian Literature
18.589	Colonial Discourse and Native Literature in Canada

Film Studies

19.528	Canadian Cinema

French

20.504	Linguistique du français canadien
20.550	Littérature canadienne-française I
20.551	Littérature canadienne-française II
20.563	Littérature et les autres arts

Geography

45.423	Urban Revitalization
45.425	Space, Place and Well-Being
45.426	Health, Environment and Society
45.427	Urban Development and Analysis
45.431	Advanced Cultural Geography
45.435	Historical Geography
45.442	Transportation Geography
45.444	Outdoor Recreational Land Use
45.541	Society and Space
45.543	Selected Concepts in Cultural Geography
45.545	Problems in Historical Geography
45.570	Problems of Development in Arctic and Subarctic Environments
45.572	Issues in Canadian Resource Development
45.579	Research and Development in Outdoor Recreational Geography

History

24.421	Science and Technology in the Canadian Experience
24.422	The Maritimes in Transition, 1870s to 1920s
24.424	Canadian Immigration and Ethnic History
24.425	Selected Problems in the Political Economy of Canadian Labour
24.426	Perspectives on State Formation in Canada
24.430	Colonial Society in British North America
24.431	Canada from Confederation to the Great War
24.432	Acadian and Quebec Society before 1763
24.433	Selected Problems in Canadian Business History, 1850-1980
24.434	History of Northern Canada
24.435	Elites and Elite Formation in Canadian Society, 1800-1925

47.504	Policy Making in Canada
47.506	Problems of Canadian Government and Politics I
47.507	Problems of Canadian Government and Politics II
47.508	The Politics of Energy and the Environment
47.509	Canadian Political Economy
47.511	Canadian Federalism
47.520	Nationalism
47.521	Politics in Plural Societies
47.536	The Canadian and American Political Traditions I
47.537	The Canadian and American Political Traditions II
47.541	Canadian Public Administration and Policy Analysis
47.561	Analysis of Canadian Foreign Policy
47.600	The Political Process in Canada I
47.601	The Political Process in Canada II

Psychology

49.490	Directed Studies

Public Administration

50.500	Public-Sector Managing and the Canadian Political System
50.515	Management in the Public Service
50.516	Urban and Local Government Management
50.560	Industrial Policy: Theory and Practice I
50.561	Industrial Policy: Theory and Practice II
50.567	Political Economy of the State
50.584	Industrial Relations and Collective Bargaining
50.585	Public-Sector Collective Bargaining

Social Work

52.503	Foundations of Sexuality
52.506	Women and Welfare
52.510	History and Philosophy of Social Welfare
52.511	Social Policy Analysis
52.519	Seminar in Social Policy

Sociology

53.451	Workshop in Demography/Human Ecology
53.452	Workshop on Work and Organizations
53.525	Canadian Society
53.532	The Labour Process
53.538	Feminist Analyses
53.540	Political Sociology
53.545	Power and Stratification
53.568	Women and Work

Women's Studies

09.491	Selected Topics in Women's Studies I
09.492	Selected Topics in Women's Studies II

School of Comparative Literary Studies

Dunton Tower 1701
Telephone: 788-2177
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The School

Director of the School:
Robert Polzin
Assistant Director of the School:
G.A. Woods

The School of Comparative Literary Studies offers programs of graduate study leading to the degree of Master of Arts in Comparative Literature. These programs, involving courses in comparative literary studies and, where appropriate, up to two courses from other departments, have considerable flexibility in the sense that they can be tailored to suit each student's special interests in particular periods or areas while, at the same time, through the core half courses, Comparative Literary Studies 17.501 and 17.502, and the final comprehensive examination, providing a specialized training in the techniques of comparative literary studies.

The purpose of the program in comparative literature is to study literature in its international context, and to relate and compare literary phenomena usually studied in isolation because of linguistic barriers and the traditional departmental division of academic disciplines. Thus, taking into account the interrelation of all humanistic studies, such as the various literatures, philosophy, psychology, sociology, the visual arts, and history, "comparatists" view literary creation within the total complex evolution of world literature. The historical flow of literary archetypes, the role of folklore and myth in literature, recurrent problems of literary theory, and consideration of the less well known literatures of the world are some of the objects of comparative literary studies.

The study of this discipline must be based on a truly comparative perspective, on a solid linguistic foundation, and on an awareness of all difficulties that arise in comparative literature, conceived as a domain both within and beyond the limits of national literatures.

Students registered in other departments, who wish to register in one or more courses from the comparative literature program, must demonstrate a reading knowledge of the languages required for each course. Such students are encouraged to emphasize their own area of literary study in presentations and essays when the instructor judges that the content of the course(s) so permits. Three years of study at the university level will normally constitute the required level of language proficiency.

Qualifying-Year Program

The regulations governing admission to the qualifying-year program are outlined in the general section of this calendar.

Applicants who hold only a general (pass) B.A. degree will be required to successfully complete the basic half courses, Comparative Literary Studies 17.401: Foundations of Comparative Literary Studies and Comparative Literary Studies 17.402: Theories of Literature, and to take courses from other departments of literature, or Comparative Literary Studies (see *Undergraduate Calendar*) to achieve the equivalent of a combined honours B.A. with high honours standing.

The total course program is to be worked out in consultation with the graduate studies supervisor. Formal admission to the master's program may be considered at the end of the first term.

• Comparative Literary Studies 17.401
Foundations of Comparative Literary Studies
The history of the discipline of comparative literature will be studied, including its beginnings in nineteenth-century France, its evolution, and its current status in Europe, the United States, and Canada.
Prerequisite: Permission of the School.

• Comparative Literary Studies 17.402
Theories of Literature
The course focuses on twentieth-century literary theories in the context of comparative studies, providing the student with an overall view of the theoretical discussion of literature from about 1920 to the present. Included in the study are Russian Formalism, American New Criticism, and such other approaches as the structuralist, semiotic, socio-cultural and hermeneutic.
Prerequisite: Permission of the School.
(Students enrolling in this course under the cross-listed 38.402 should note the requirements of the Department of Spanish).

Master of Arts

Admission Requirements
The regulations governing admission to the master's program are outlined in the general section of this calendar.

The specific requirements for admission to the master's program in comparative literature are the following:
- An honours B.A. degree (or equivalent) with at least high honours standing in a literature (studied in the original language) or in two literatures or in a literature and a related arts subject
- Proficiency in English
- An ability to work at the graduate level in an additional language approved by the School. Students whose record does not clearly demonstrate this ability will be required to take as part of their program at least one half credit in the literature of this second language in the original language

Program Requirements
Students accepted into the master's program without having taken the two half courses, Comparative Literary Studies 17.401 and Comparative Literary Studies 17.402 (or their equivalent), will be required to take these courses as extra to the degree.

Master's candidates in comparative literature will follow one of three programs. The specific requirements are as follows:
- The two half courses, Comparative Literary Studies 17.501: Problems in the Theory of Literature I and Comparative Literary Studies 17.502: Problems in the Theory of Literature II
- Two full graduate courses (or the equivalent) selected from those offered by Comparative Literary Studies. With departmental approval, one of these full courses may be a 400-level course. Courses in other programs in the University may also be selected with permission of the Graduate Committee, but normally not in excess of one full course (or the equivalent)
- *Either* Comparative Literary Studies 17.599: M.A. Thesis (equivalent to two full course credits); *or* Comparative Literary Studies 17.598: Research Essay (one full credit) and Comparative Literary Studies 17.593: M.A. Comprehensives (one full credit); *or* an additional full graduate course (or the equivalent) and 17.593: M.A. Comprehensives (one full credit)

Guidelines for Completion of Master's Degree in Comparative Literature
The master's program is normally completed no later than two years or six terms after initial full-time registration and six years or eighteen terms after initial part-time registration.

Graduate Courses*

A prerequisite for all graduate-level courses is appropriate linguistic ability and approval of the School of Comparative Literary Studies. A student may not receive credit for both a half course and a full course which bears the same topic title.

- Comparative Literary Studies 17.501W1
Problems in the Theory of Literature I
Topic for 1994-95: Specular Narratology
The problems studied in this course include the following: what do narratives tell readers about the ways they construct themselves as stories about a certain reality? What do they tell us about their own truth value and the techniques they use to convey it? What to they tell us about the hermeneutics of either telling or reading a story?
Prerequisite: Permission of the School.
Fernando de Toro.

- Comparative Literary Studies 17.502W1
Problems in the Theory of Literature II
Topic for 1994-95: Reference, Sense and Meaning: Theoretical Problems in Interpretation
This course focuses on some of the theoretical problems that text semantics pose for literary interpretation. Emphasis is placed on exploring the external/internal fields of textual reference, the language-specific sense of discourse and the processes by which meaning effects are conveyed. Literary texts will come from twentieth-century English, French, German and Spanish poetry and short fiction.
Prerequisite: Permission of the School.
H.-G. Ruprecht.

- Comparative Literary Studies 17.521F1
Literary History II: Studies of Themes and Myths
Topic for 1994-85: Forms of Displacement: Modernity and Travel
The course will examine questions pertaining to exile, emigration, exploration, nomadism and tourism in relation to the twentieth-century novel and short story. The reflection on travel and its role now taking

* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

place in literary theory and such disciplines as anthropology, geography and psychoanalysis will also be considered. The authors on the reading list will include Achebe, Conrad, Forster, Gordimer, Joyce, Paci, Pavese, Jelloun. Providing the linkage with theory and non-literary discourses will be articles and excerpts by Bakhtin, Deleuze, Freud, Lévi-Strauss, Lotman, Lukacs, MacCannell, Said and Tuan.
Prerequisite: Permission of the School.
F.G. Loriggio.

• Comparative Literary Studies 17.522F1
Literary History III: Periods, Styles and Movements
Topic for 1994-95: Lowell and Larkin: A Cross-Cultural Comparison
A comparison of the work and careers of Robert Lowell and Philip Larkin in the framework of their historical positions in American and British poetry. Particular attention will be paid to their attitudes to Anglo-American modernism. An attempt will be made to attain a focus on differences in development of American and British poetry in the mid-twentieth century. Texts by Lowell, Larkin, and Alvarez.
Prerequisite: Permission of the School.
(Also offered as English 18.561)
A.T. Tolley.

• Comparative Literary Studies 17.523W1
Literary History IV: Form and Function of Genres
Topic for 1994-95: Updating the Comic: Laughter in Twentieth-Century Literature and Other Discourses
The focus of the course will be the function (transgressive, integrative etc.) of laughter in twentieth-century theatre and in the discussions of the comic and comedy undertaken by such disciplines as philosophy, psychoanalysis and anthropology. Literary texts will come primarily from Beckett, Campanile, Fo, Ionesco, Pirandello, Stoppard. Theoretical and non-literary material will include works or excerpts of works by Bergson, Bakhtin, Bataille, Eco, Eliade, Freud, Frye, Jung and Nietzsche. Some films (Marx Brothers, Woody Allen) will also be studied.
Prerequisite: Permission of the School.
F.G. Loriggio.

• Comparative Literary Studies 17.532T2
Studies in the Literature of Identity
Topic for 1994-95: Female Identity: Writing by Women in the Twentieth Century
This course will explore topics such as gender and narrativity, women's space, marginalization, women and madness, and mothers and daughters in writing by women in the first half of the twentieth century in northern Europe and North America. The texts will be discussed from a cross-cultural perspective with reference to poststructuralist literary theory,

including feminist criticism. Texts include: Dinesen, Woolf, Colette, Stein, de Beauvoir, Skram, Undset, Salverson, and Roy.
Prerequisite: Permission of the School.
G.A. Woods.

• Comparative Literary Studies 17.554T2
Cross Cultural Studies I: Literatures Written in the English Language
Topic for 1994-95: The Fourth World and the Edge of Empire
The course will study the emergence of indigenous literatures in the modern world. Attention will focus primarily on texts from Australia, New Zealand, and the United States but some works by South African and Latin-American writers will also be discussed, as will some works by non-indigenous writers. Among the authors included in the reading list are: Sally Morgan, Hyllus Maris (Australia); Witi Ihimaera, Keri Hulme (New Zealand); Marmon Silko, Gerald Vizenor, Alice Walker (U.S.); Wilma Stockenstrom (South Africa); Marquez (Columbia).
Prerequisite: Permission of the School.
Before 1994-95 course 17.554 was offered as 17.550. (Also offered as English 18.504)
J.J. Healy.

• Comparative Literary Studies 17.556W1
Cross-Cultural Studies IIB: Literature of the of the Francophonie
Topic for 1994-95: Poétiques des littératures francophones dans l'espace antillais et les aires de diaspora
Analyse de l'émergence des littératures francophones des Caraïbes (Haïti, Martinique, Guadeloupe et Guyane). Les poétiques des poètes et poèticiens: A. Césaire, E. Glissant, Frankétienne, R. Depestre, L.G. Damas. Analyse de l'émergence d'une poésie migrante contemporaine (Montréal). Analyse des poétiques dans les aires de métissage culturel et littéraire, analyse des interrelations vernaculaires et véhiculaires.
Prerequisite: Permission of the School.
Before 1994-95 course 17.556 was offered as 17.551.
Pierre Laurette.

• Comparative Literary Studies 17.558W1
Comparative Canadian Literature I
Topic for 1994-95: Fictional Autobiographical Narratives: Theory and Practice
This course aims to define the characteritics of various autobiographical narratives/"récits autobiographiques" through the readings of theoretical works from France, the United Kingdom, Canada and the United States. Using a corpus of Québécois and English-Canadian novels, we will study the defining characteristics of various autobiographical "sous-genres" (diary, memoirs,

autobiography, epistolary, etc.) Although the course will emphasize fictional autobiographical narratives/"récits autobiographiques fictifs", we will also look at non-fictional autobiographical narratives. The fictional/factual opposition will allow for the discussion of a series of epistemological and narrative questions involving problems of simulation, reference, representation, fictionalization, postmodernism, historiography and the rhetoric of truth claims. Texts by H. Aquin, N. Brossard, D. Godfrey, D. Marlatt, M. Monette, M. Ouellette-Michalska, M. Ondaatje.
Prerequisite: Permission of the School.
Before 1994-95 course 17.558 was offered as 17.553.
Julie LeBlanc.

• Comparative Literary Studies 17.561F1
Studies in Postmodernism I
Topic for 1994-95: Postmodern Theory
This course deals with the theories of postmodernism and their relation to feminist theory in art, philosophy, architecture, literature, and theatre. Some of the authors that will be considered are J. Baudrillard, H. Cixous, T. de Lauretis, G. Deleuze, A. de Toro, D.W. Fokkema, F. Guattari, L. Hutcheon, L. Irigaray, C. Jencks, J. Kristeva, D. LaCapra, J-F. Lyotard, T. Moi, L. Nicholson, P. Portoghesi, G. Spivak, R. Venturi, A. Warhol.
Prerequisite: Permission of the School
Fernando de Toro.

• Comparative Literary Studies 17.562W1
Studies in Postmodernism II
Topic for 1994-95: Postmodern Fiction
This course will examine postmodern fiction and fiction by women through focusing on their differences and similarities in the use of narrative strategies and techniques such as genre subversion, non-fictionality, memory, historicity, the palimpsest, intertextuality and rhizomatic writing in the work of authors such as K. Acker, J. Banville, J. Barnes, J.L. Borges, N. Brossard, A. Carter, H. Cixous, J.M. Coetzee, U. Eco, G. García, Márquez, M. Puig, A. Roa Bastos.
Prerequisite: Permission of the School.
Fernando de Toro.

• Comparative Literary Studies 17.565F1
Intertextuality: Literature and Other Cultural Phenomena
Topic for 1994-95: Intertexuality as Discursive Appropriation, Subversion and Manipulation: Modern and Postmodern Artistic Practices
This course deals with the discursive manifestations of intertextual relations, i.e. with the various forms of textual networks including the ironic transformation of classic genres, the subversive use of canonic writings, and the manipulatory transcoding

of the cultural dialogue between modern and postmodern art, poetry, theatre and fiction. Texts by Anouilh, Atwood, Barnes, Borges, Brecht, Coetzee, Donoso, Eliot, Handtke, Joyce, Lima, Plenzdorf, Roth, Tournier, Vargas Llosa.
Prerequisite: Permission of the School.
H.-G. Ruprecht.

• Comparative Literary Studies 17.580F1
Seminar in Comparative Literary Studies
Topic for 1994-95: Interfaces of Deconstruction: Nietzsche, Heidegger, Derrida and the Literary Experience
Devoted to the presentation and discussion of deconstructive thinking in contemporary criticism, the seminar concerns itself with the fundamental ideas and conceptual frameworks of deconstruction as practised by Jacques Derrida. This includes, necessarily, selected readings of Nietzsche's and Heidegger's writings about literature.
Prerequisite: Permisison of the School.
H.-G. Ruprecht.

• Comparative Literary Studies 17.582F1
Seminar in Comparative Literature
Topic for 1994-95: Critical Theory and the Bible
An exploration of trends in biblical scholarship influenced by current literary theory and the philosophy of language. Selected biblical texts from Deuteronomy through II Kings are interpreted according to these new approaches.
Prerequisite: Permission of the School.
(Also offered as Religion 34.520)
Robert Polzin.

• Comparative Literary Studies 17.593F2, W2, S2
Comprehensives

• Comparative Literary Studies 17.595F3, W3
Study Abroad
Under the terms of the accord with l'Université de Picardie in France, Università di Bari in Italy, and Universidad de Buenos Aires in Argentina, students may do a part of their work for the M.A. in Comparative Literature in France, Italy and Argentina. The content of the study will be decided by the School of Comparative Literary Studies at Carleton. Only students sponsored by the School under the exchange may take this course. Work done in France, Italy and Argentina will be the subject of a report from l'Université de Picardie, Università di Bari, and the Universidad de Buenos Aires and will receive a final grade awarded by the School of Comparative Literary Studies at Carleton.
Prerequisite: Permission of the School.

• Comparative Literary Studies 17.596T2
Directed Special Studies
From time to time, students whose main interests
are not covered by courses offered in a given year
may pursue independent research, subject to the
availability of a qualified adviser and relevant library
resources at Carleton. Interested students should
apply directly to the supervisor of graduate studies.

• Comparative Literary Studies 17.597F1, W1, S1
Directed Special Studies
From time to time, students whose main interests
are not covered by courses offered in a given year
may pursue independent research, subject to the
availability of a qualified adviser and relevant library
resources at Carleton. Interested students should
apply directly to the supervisor of graduate studies.
Before 1993-94 course 17.597 was offered as 17.598.

• Comparative Literary Studies 17.598F2, W2, S2
Research Essay

• Comparative Literary Studies 17.599F4, W4, S4
M.A. Thesis

Courses Not Offered in 1994-95

17.520	Literary History I
17.540	Studies in Modernism and Postmodernism
17.543	Paraliterature
17.555	Cross-Cultural Studies II: Literature of the Francophonie
17.557	Cross-Cultural Studies III: Literature of the Luso-Hispanic World
17.559	Comparative Canadian Literature II
17.571	The Theory and Practice of Translation
17.581	Seminar in Comparative Literature

Department of English Language and Literature

Dunton Tower 1812
Telephone: 788-2310
Fax: 788-3544

The Department

Chair of the Department:
R.B. Lovejoy
Departmental Supervisor of Graduate Studies:
L.T.R. McDonald

The Department of English Language and Literature offers programs of study leading to the M.A. degree in English language and literature. Additional information may be obtained by consulting the departmental supervisor of graduate studies.

Qualifying-Year Program

Applicants who hold a general (pass) B.A. degree with at least a high honours standing (normally B+), with a major in English language and literature, may be admitted to the qualifying-year program. Normally, these students will be required to complete four or five full courses (or the equivalent) in English, as determined by the department, and to maintain a high honours standing (normally B+) before being considered for admission into the master's program.

Master of Arts

Admission Requirements

The minimum admission requirement for the master's program is an honours B.A. (or the equivalent) in English language and literature, with at least a high honours standing (normally B+), and including at least five of the following:
- history of the English language or general English linguistics
- Old English or Middle English
- Renaissance literature
- drama (including Shakespeare)
- Restoration and eighteenth-century literature
- Romantic and nineteenth-century literature
- twentieth-century literature
- Canadian literature

Possession of the minimum entrance standing is not in itself, however, an assurance of admission into the program.

Program Requirements

Each candidate will select one of the following program patterns:
- The equivalent of two full-credit courses in English, selected from those at the 500 level (excluding English 18.598), plus English 18.505, Bibliography and Scholarly Methods, and a master's thesis; an oral examination on the thesis will be required. A prospectus for the thesis must be submitted to the graduate committee by December 1 after registration in September, or at the end of three months for any other registration
- The equivalent of three full-credit courses in English selected from those at the 500 level (excluding English 18.599), plus English 18.505, Bibliography and Scholarly Methods, and a research essay; an oral examination on the research essay will be required

Each program is designed to be completed within the three-term academic year. Each program is of equal status.

Full-time master's candidates are expected to complete all requirements in twelve months or three terms of registered full-time study. Part-time master's candidates are expected to complete their degree requirements within an elapsed period of six calendar years after the date of initial registration.

All candidates are required to demonstrate a reading knowledge of one language other than English, approved by the Department.

Academic Standing

A standing of B– or better must be obtained in each course counted towards the master's degree.

Graduate Courses*

- English 18.502W1
Contemporary Literary Theory
Topic for 1994-95: Victorian Cultural Critique and its Legacy
A study of ideas of culture in Great Britain in the nineteenth century, as represented in selected writings of a number of "sages" — Coleridge, Carlyle, Ruskin, Arnold, and Morris — and of the discourses generated from these writings, as developed in the

* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

twentieth century by F.R. Leavis, Raymond Williams and contributors to the burgeoning discipline of cultural studies. Supplementary readings from Marx and Gramsci.

• English 18.503F1
Feminism/s: The Literary Dimension
Topic for 1994-95: Essentialist and Anti-Essentialist Feminist Criticisms
The course will focus on the current debate over the potential political agency of anti-essentialist discourse, and will re-examine the effects of anti-essentialism and its dominant position in contemporary theory.

• English 18.504T2
Literature, Contact and Empire in Colonial and Post-Colonial Societies
Topic for 1994-95: The Fourth World and the Edge of Empire
This course will study the emergence of indigenous literatures in the modern world. Attention will focus primarily on texts from Australia, New Zealand, and the United States but some works by South African and Latin-American writers will also be discussed, as will some works by non-indigenous writers. Among the authors included in the reading list are: Sally Morgan, Hyllus Maris (Australia); Witi Ihimaera, Keri Hulme (New Zealand); Marmon Silko, Gerald Vizenor, Alice Walker (U.S.A.); Wilma Stockenstrom (South Africa); Marquez (Columbia). (Also offered as Comparative Literary Studies 17.554)

• English 18.505F1
Bibliography and Scholarly Methods
An introduction to analytical and descriptive bibliography, editing, research methodology and professional concerns. The course is graded Satisfactory/Unsatisfactory.

• English 18.528S1
Middle-English Studies
A study of selected portions of Chaucer's *Canterbury Tales* from the perspective of Bakhtinian literary theory. The Miller, the Wife of Bath, the Pardoner, and the Host will be among those elements of the work examined in the light of Mikhail Bakhtin's writings on the ludic and carnivalesque and on grotesque realism. Familiarity with *Rabelais and His World* and *The Dialogic Imagination* will be involved in the course.
Also offered at the undergraduate level, with different requirements, as 18.428, for which additional credit is precluded.

• English 18.534W1
Renaissance Drama
Topic for 1994-95: Politics and the English Renaissance Stage
A study of the popular drama of Marlowe, Shakespeare, Jonson, Marston, Webster and Tourneur and the court drama of Peele, Jonson, Shirley and Carew.

• English 18.542W1
Eighteenth-Century Studies
Topic for 1994-95: Eighteenth-Century Novels
A formal consideration of Fielding's *Tom Jones*, Richardson's *Clarissa* and Sterne's *Sentimental Journey* with particular attention to issues of gender and class.

• English 18.548W1
Studies in Romanticism
Topic for 1994-95: Blake
The course will examine the "belief" structures of Blake's poetry (including illustrations) in the context of contemporary thinking about "difference." *The Marriage of Heaven and Hell* and *Milton* will receive special attention.

• English 18.551S1
Studies in Romanticism
Topic for 1994-95: Shelley, Byron and Keats
This course will address the major poems of Keats and a representative selection of Byron and Shelley. Also offered at the undergraduate level, with different requirements, as 18.448, for which additional credit is precluded.

• English 18.561F1
Literary History III: Periods, Styles and Movements
Topic for 1994-95: Lowell and Larkin, a Cross-Cultural Comparison
A comparison of the work and careers of Robert Lowell and Philip Larkin in the framework of their historical positions in American and British poetry. Particular attention will be paid to their attitudes to Anglo-American modernism. An attempt will be made to attain a focus on differences in development of American and British poetry in the mid-twentieth century. Texts by Lowell, Larkin and Alvarez.
(Also offered as Comparative Literary Studies 17.522)

• English 18.566F1
Twentieth-Century Literature
Topic for 1994-95: Studies in Post-World War II British Fiction
This course will consider selected novels within the context of post-modernism.

• English 18.571F1
American Poetry
Topic for 1994-95: The Birth of Modernism
This seminar focuses on selected major figures who
have shaped American poetry in this century.
Within the context of modernism, poems will be
considered in the light of literary movements and
the theory found in the critical writings of these
poets. The poets to be studied include: William
Carlos Williams, *Pictures from Brueghel*; Ezra
Pound, *Selected Poems*; Wallace Stevens, *The Palm
at the End of the Mind*; Charles Olson, *Selected
Writings*; T.S. Eliot, *The Waste Land and Other
Poems*; Alan Ginsberg, *Howl and Other Poems* and
Kaddish and Other Poems.
Also offered at the undergraduate level, with
different requirements, as 18.471, for which
additional credit is precluded.

• English 18.573W1
American Fiction
Topic for 1994-95: Social Transgression in the
American Novel
This course will look at writers such as Hawthorne,
Wharton, James, Cather and Morrison with a specific
emphasis on adultery.

• English 18.581W1
Canadian Poetry
Topic for 1994-95: Post-Modernism and the
Politics of Location: Contemporary Canadian
Women Poets
This course will engage texts by Canadian writers
from diverse social contexts who appropriate
post-modern aesthetics and strategies of critique
for specific projects of feminist cultural intervention.
Questions of identity politics raised by constructions
of voice, among other poetic strategies, will be
integral. Inquiry into the relationships between
power, knowledge-formation, social agency, and
poetics will also be relevant.

• English 18.582W1
Ethnicity, Multiculturalism, and Canadian Literature
Topic for 1994-95: Minority Ethnic Writing
A study of Canadian literature in relation to theo-
retical and critical issues posed by ethnicity and
other aspects of Canadian cultural diversity.

• English 18.583F1
Canadian Fiction
Topic for 1994-95: Contemporary Canadian Novels
The course will concentrate on Canadian writing of
the last twenty to thirty years, exploring it with
reference to the concept of ideology, within the
contexts of Marxist, feminist, and post-modernist
literary theories.

• English 18.587S1
Selected Topic in Canadian Literature
Topic for 1994-95: Exile, Displacement and Alien-
ation in Five Works of Canadian Fiction
This seminar will examine Frederick Philip Grove's
A Search for America, John Glassco's *Memoirs of
Montparnasse*, Leonard Cohen's *Beautiful Losers*,
Margaret Atwood's *Lady Oracle*, and Marian
Engel's *Bear*. The seminar will concern itself with
the structure of the literary work, its fictional
strategies, its cultural impact, and its literary and
historical context.
Also offered at the undergraduate level, with differ-
ent requirements, as 18.487, for which additional
credit is precluded.

• English 18.589F1
Colonial Discourse and Native Literatures in Canada
Topic for 1994-95: Explorers, Fur Traders, Settlers
and Other Invaders
An investigation of aspects of the dominant discourse
about native peoples in Canada and the emergence
of the counter-discourse which has been produced
by native writers and story tellers.

• English 18.593W1
English and Cultural Studies
Topic for 1994-95: The Language of Empire
The course will examine metaphorical expressions
of British imperialism during the period 1880-1918,
focusing on militarist, missionary, and adventure
discourses.

• English 18.598F2, W2, S2
Research Essay

• English 18.599F4, W4, S4
M.A. Thesis

Undergraduate Courses

Graduate students may take the equivalent of *one*
full-credit course at the senior undergraduate level.

Other Disciplines

Graduate students may take the equivalent of *one*
full-credit course in a related discipline. The following
courses may be among those of special interest:**

Comparative Literary Studies
17.401   Foundations of Comparative Literary
          Studies

** This is not a complete list of all the acceptable options.
Students should contact the supervisor of graduate studies or
the chair for approval if there are other courses they wish to
take which are not on this list.

17.402	Theories of Literature
17.501	Problems in the Theory of Literature I
17.502	Problems in the Theory of Literature II

Other Universities

Graduate students may take the equivalent of *two* full-credit courses at another university or other universities. Students are especially reminded that the University of Ottawa offers a wide range of graduate courses which may be completed (under the general two full-course credit ruling) for credit at Carleton.

Courses Not Offered in 1994-95

18.500	Literary Criticism
18.518	Old Norse
18.531	Renaissance Poetry
18.532	Seventeenth-Century Poetry
18.537	Renaissance Authors
18.538	Renaissance Studies
18.551	Nineteenth-Century Poetry
18.553	Nineteenth-Century Fiction
18.558	Nineteenth-Century Literature
18.561	Twentieth-Century Poetry
18.563	Twentieth-Century Fiction
18.564	Twentieth-Century Drama
18.567	Twentieth-Century Authors
18.568	Twentieth-Century Studies
18.576	American Literature
18.578	Studies in American Fiction
18.585	Canadian English
18.591	Selected Topic
18.594	Special Studies in Dramatic Literature

School for Studies in Art and Culture
Film Studies

St. Patrick's Building 425
Telephone: 788-5606
Fax: 788-3575

The School
St. Patrick's Building 425

Director:
John Shepherd
Assistant Director (Film Studies):
Mark Langer

Film Studies does not offer a program of studies at
the graduate level, but does offer a course at the
graduate level, under the aegis of the School of
Canadian Studies.

Graduate Courses*

● Film Studies 19.528T2
Canadian Cinema
Through a close analysis of films from both cultures,
this course should establish the distinctly Canadian
modes our cinema has developed. Special attention
will be paid to the similarities and differences between
English Canada and Quebec, relating them both to
the economic and political realities of our country,
and to the variety of thematic orderings of Canadian
culture that can be found in the work of writers like
Northrop Frye and Margaret Atwood.
Also offered at the undergraduate level, with differ-
ent requirements, as 19.328, for which additional
credit is precluded.

* F,W,S indicates term of offering. Courses offered in the fall *and*
winter will be followed by T.
The number following the letter indicates the credit weight of the
course: 1 denotes a half-course credit, 2 denotes a full-course credit,
etc.

Department of French

Dunton Tower 1602
Telephone: 788-2168

The Department

Chair of the Department:
Charles Doutrelepont
Departmental Supervisor of Graduate Studies:
J.-J. van Vlasselaer

The program of studies leading to a Master of Arts degree in French consists of courses (one-half credit each) covering the fields of French linguistics, linguistic analysis of literary discourse, literary history and literary criticism. The availability of a great variety of courses and the existence of 20.580, 20.598 and 20.599, in which the student establishes course content in consultation with his/her adviser allow for considerable flexibility and choice in wide ranging or highly specialized studies.

Qualifying-Year Program

Applicants who hold a general (pass) bachelor's degree with at least B standing or higher, with a major in French, will be required to register in the qualifying-year program (normally five courses in French chosen from those numbered at the 400 level), and maintain at least B+ standing overall, before proceeding to the M.A. program.

Qualifying-year students should consult the undergraduate calendar for a listing of 400-level courses.

Master of Arts

Admission Requirements
The normal requirement for admission into the master's program is an honours B.A. in French with at least high honours standing (normally B+ or better in honours subject; B− or better overall).

Program Requirements
Students will establish their programs in consultation with an adviser from the Department who will normally be the graduate supervisor or the professor with whom they are taking 20.598 Research Essay, or 20.599 M.A. Thesis, if they have chosen the second or third option.

The following three options are available:
- Four credits of which at least three must be chosen from courses at the 500 level; and an oral and written examination (Comprehensive), equivalent to one credit, in which the student will demonstrate a good grasp of the tools and methods of scholarship, as well as competence in chosen specialized areas
- Four credits of which at least three must be chosen from courses at the 500 level; and a Research Essay equivalent to one credit (20.598), with an oral examination
- Three credits of which at least two must be chosen from courses at the 500 level; and a master's thesis equivalent to two credits (20.599), with an oral examination

With the approval of the supervisor of graduate studies, master's students in French may select the equivalent of one full-credit course at the graduate or senior undergraduate level outside the 500-level courses offered by the Department.

Academic Standing
A grade of at least B− must be obtained in each course counted for credit towards the master's degree.

Graduate Courses*

The graduate courses offered by the department are open to students in the M.A. program and, with permission of the Department, to students in the qualifying-year program. For prerequisites, please consult the Department.

- French 20.504F1
Linguistique du français canadien
Sociolinguistique du français ontarien. Etude descriptive et analyse des variétés de français parlé en Ontario, tant au plan phonologique, morpho-syntaxique que lexical. Application de notions sociolinguistiques, théoriques et méthodologiques au français parlé en Ontario. Phénomènes de co-variation linguistique et sociale. Normes et usages. Perception et attitudes. Langues en contact et restriction. (Poplack, Mougeon & Beniak).
Robert Fournier.

* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- French 20.504W1

Linguistique du français canadien.
Les anglicismes. Etude des sources des anglicismes
que l'on retrouve dans le lexique du français
canadien. Analyse et critique des classements
proposés par différents linguistes. Domaines,
intégration des anglicismes. Conscience linguistique
des sujets parlants face aux anglicismes. Enquêtes
sur le terrain.
Sinclair Robinson.

- French 20.506F1

Linguistique du français langue seconde
Analyse de concepts non-réductionnistes en
apprentissage de la langue. Dans cette perspective,
nous entreprenons une étude des rapports entre les
sciences humaines, certaines théories de la
connaissance (Bachelard, Bateson, Atlan) et les
éléments linguistiques liés à l'enseignement/
apprentissage de la langue.
J.-J. van Vlasselaer.

- French 20.507F1

Traduction: théorie et pratique
Poésie et traduction. Après une introduction
théorique où seront notamment abordés le problème
des équivalences, du genre, de la traduisibilité de la
métaphore et de la traduction en vers, les exercices
pratiques porteront sur la traduction de textes
poétiques de l'anglais vers le français (poètes
canadiens-anglais et poètes anglophones) et du
français vers l'anglais (poètes du Québec et de la
francophonie).
Evelyne Voldeng.

- French 20.520W1

Aspect linguistique particulier
Francophonie et français contemporains. Etat de la
francophonie dans le monde. Sociolinguistique et
évolution historique des français contemporains.
Enjeux socio-économiques et politiques. Le français
des Amériques. (Chaudenson 1989: Vers une
révolution francophone; Aeger 1990: Sociolinguistics
and Contemporary French; Chaudenson, Mongeon &
Beniak 1992: Vers une étude panlectale de la variation
en français).
Robert Fournier.

- French 20.543W1

Littérature et idéologie
Le théâtre mythologique du 20e siècle. Ce cours se
propose d'étudier un phénomène tout à fait particulier
au théâtre français soit traditionnel soit moderne:
l'emploi systématique de l'ancienne mythologie
gréco-latine dans un contexte historique bien
différent de celui de ses origines. Un nombre
d'auteurs représentatifs seront examinés: à savoir,
Anouilh, Giraudoux, Sartre, Camus. On considérera

les questions suivantes: par quelles sortes
d'allégories politiques et philosophiques ce théâtre
est-il dominé? Quelle sorte de public présuppose-t-il?
Quel est le rapport entre le monde fictif du texte
dramatique et le monde référentiel que ce texte est
censé mettre en question?
E.N. Zimmerman.

- French 20.544F1

Auteurs I
Examen détaillé de l'oeuvre de Maryse Condé,
romancière guadeloupéenne. Il s'agit de montrer les
"tracées" de son art, selon le projet de Patrick
Chamoiseau et Raphael Confiant, *Lettres créoles;
tracées antillaises et continentales de la littérature*.
Le trajectoire de cette littérature se dessine à travers
l'histoire africaine, *Heremakhonon, Une Saison à
Rihata*; l'histoire américaine, *Moi, Tituba Sorcière
de Salem, noire de Salem*, et l'histoire guadeloupéenne,
lieu de convergence de toutes les différences,
Traversée de la Mangrove.
Alvina Ruprecht.

- French 20.544W1

Auteurs I
Etude détaillée des écrits d'Antonin Artaud sur le
théâtre. Il s'agit de ses écrits théoriques sur la
pratique scénique, (*Le Théâtre et son Double*, *Le
Théâtre Alfred Jarry*), de ses écrits anthropologiques
sur le rituel non occidental (*Le rite du Peyotl*), et de
sa création textuelle: scénarios, traductions et
critiques théâtrales. Les traces de ses théories
seront repérées dans la pratique théâtrale
contemporaine en Europe et en Amérique du Nord;
Grotowski (Pologne), Beck (Etats-Unis), Crête
(Québec).
Alvina Ruprecht.

- French 20.545F1

Thèmes, écoles, mouvements
Le féminisme littéraire en France et au Québec.
Etude des questions principales abordées par
l'écriture et la théorie féministes, en France et au
Québec (par exemple, le rapport entre femmes et
langage, l'origine maternelle et la construction de la
culture, la place du corps sexué dans l'écriture).
Nous étudierons un certain nombre d'oeuvres
littéraires féministes à la lumière de la théorie
féministe, et vice versa, suivant ainsi au cours du
semestre l'étroite interdépendance des deux
domaines. Textes théoriques et/ou fictifs de Luce
Irigaray, Hélène Cixous, Marie Cardinal, Nicole
Brossard, France Théoret, Denise Boucher.
Patricia Smart.

• French 20.545F1
Thèmes, écoles, mouvements
L'âge des Lumières et des utopies. Le siècle des
lumières se caractérise par deux courants de pensée
opposés. D'un côté, on assiste à l'affirmation de
valeurs rationalistes et individualistes, affirmation
qui culmine dans l'éloge des sciences et des arts et
dans l'exaltation du progrès de la civilisation. De
l'autre, on prône le retour à la nature, à la vie
agricole et on présente des projets de vie sociale
communautaire, que l'on a qualifiés d'utopiques.
Ce cours consistera à expliquer cette opposition à
partir des bases sociales des idées illustrées par
divers auteurs; idées dont la critique actuelle n'a
pas toujours saisi le caractère antithétique et
l'origine profonde. Ce cours aura comme objet les
auteurs suivants (en anthologie): Voltaire, Rous-
seau, Montesquieu, Diderot, Bayle, Fontenelle,
Hélvétius, d'Holbach, La Mettrie.
Renato Galliani.

• French 20.546F1
Genres I
La modernité du XVIIIème siècle. On étudiera dans
ce cours comment, en deçà et au delà de la
parenthèse réaliste (transparence) du XIXème, le
XVIIIème et le XXème siècles littéraires sont liés
par une série d'échos ayant principalement à voir
avec la question de la relation réalité-fiction, c-à-d
avec le langage (femmes, artifice, érotisme). Textes
de Diderot, Marivaux, Crébillon fils, Sollers, Duras.
Dominique Rosse.

• French 20.547F1
Genres II
La ville au XIXe siècle. Analyse détaillée du thème
de la ville dans la poésie française du XIXe siècle.
Situation de la thématique urbaine dans la
littérature. Etude des premières manifestations, les
scènes de rue d'Aloysius Bertrand. La ville et la
"modernité", étude détaillée de la ville dans *Le
Spleen de Paris* de Baudelaire. La ville à la fin du
siècle: villes symbolistes et agonisantes. Textes au
programme: Aloysius Bertrand, *Gaspard de la nuit;*
Baudelaire, *Le Spleen de Paris*; Huysmans, *Les
Soeurs Vatard*; Rodenbach, *Bruges-la-morte.*
Charles Doutrelepont.

• French 20.547W1
Genres II
Différentes formes du réalisme au XIXème siècle.
Etude détaillée des éléments narratifs constitutifs
du discours réaliste (description, personnages,
discours) afin d'en dégager les invariants, mais
aussi la spécificité de chaque auteur (son rythme)
par rapport à ces invariants (ironie balzacienne,

parodie flaubertienne). Textes de Balzac, Maupassant,
Flaubert, Stendhal, Zola, Barbey.
Dominique Rosse.

• French 20.548W1
Littérature française I
Le réalisme dans la poésie de la fin du Moyen Age:
Rutebeuf (XIIIe siècle) et Villon (XVe siècle), le
portrait de deux êtres aux prises avec l'infortune,
qui est en partie celle de leur condition sociale.
L'oeuvre de Villon sera vue en moyen français,
d'un abord peu difficile, et celle de Rutebeuf en
édition bilingue (vieux français, français moderne).
Textes: Rutebeuf, *Oeuvres poétiques*, édition M.
Zink, Bordas; Villon, *Oeuvres*, édition A. Mary,
Bordas.
Jean Miquet.

• French 20.550F1
Littérature canadienne-française I
Le roman québécois postmoderne. L'objectif de ce
cours sera de lire certains romans québécois à la
lumière d'un concept qui, depuis plus d'une décennie,
ne cesse de donner lieu à de nombreuses ambiguïtés
conceptuelles: il s'agit du terme "postmoderne". En
recourant à des écrits d'ordre théorique (J. Barth,
L. Hutcheon, J.-F. Lyotard, J. Paterson etc.), le propos
initial de ce cours sera de mettre en place une typologie
du roman postmoderne. Après avoir déterminé ce que
signifie cette étiquette, il s'agira ensuite de repérer
dans certaines oeuvres québécoises les traits essentiels
du roman postmoderne. Romans à l'étude: Hubert
Aquin, *Trou de mémoire*; Gérard Bessette, *Le
Semestre*; Gilbert La Rocque, *Les Masques*;
Jacques Poulin, *Volkswagen Blues.*
Julie LeBlanc.

• French 20.551W1
Littérature canadienne-française II
Connotations et codes dans l'oeuvre d'Hubert
Aquin: Etude des lexies dans les romans suivants,
*Prochain Episode, Trou de mémoire, L'Antiphonaire,
Neige Noire.* A consulter: *S/Z*, Roland Barthes;
Point de fuite, Blocs erratiques, H. Aquin.
Donald Smith.

• French 20.580F1, W1, S1
Cours de lectures dirigées
Sujet établi sur proposition de l'étudiant en
consultation avec son conseiller.

• French 20.597F2, W2, S2
Comprehensive Examination

• French 20.598F2, W2, S2
Mémoire de recherche
Tout(e) étudiant(e) qui ne fait pas de thèse, choisira
un directeur d'études avec qui il/elle préparera un
mémoire d'une cinquantaine de pages sur un sujet

de son choix. Ce travail sera sanctionné par un examen oral.

• French 20.599F4, W4, S4
M.A. Thesis

Courses Not Offered in 1994-95

20.501	Théories linguistiques françaises
20.502	Linguistique du français I
20.503	Linguistique du français II
20.541	Sémiotique littéraire
20.542	Littérature et rhétorique
20.549	Littérature française II
20.561	Sémiotique culturelle
20.562	Littérature, société, communication
20.563	Littérature et les autres arts
20.564	Paralittératures
20.570	Aspect littéraire culturel particulier

Department of German

Dunton Tower 1315
788-2116

The Department

Chair of the Department:
Basil Mogridge
Departmental Supervisor of Graduate Studies:
Jutta Goheen

The program of studies leading to the degree of Master of Arts in German has two streams: the study of German literature and the study of German linguistics respectively.

The literature stream of the program focuses on the development of narrative (from the medieval epic to the modern short story) as a genre. Course offerings, though, are not confined exclusively to this area.

The linguistics stream of the program concentrates on structures of modern oral and written German in the context of linguistic change, and the history of German linguistics.

Students in each stream are encouraged to include some course work from the other stream as part of their program. In addition, any student may be granted permission, where appropriate, for enrolment in course offerings in the School of Comparative Literary Studies for up to the equivalent of one full credit. Any student with a special interest in the field of German not explored in the curriculum is invited to develop it within the framework of a thesis or research essay.

Admission Requirements

Departmental requirements conform to those outlined for master's students in the general section of this calendar. Further information concerning graduate work in German may be obtained from the Department.

Program Requirements

Literature Stream
Master's students specializing in German literature will normally be required to select and follow one of three alternative program patterns:
- Three full courses (or the equivalent) and a thesis
- Four full courses (or the equivalent) and a research essay
- Five full courses (or the equivalent)

Within the chosen program pattern, students in the literature stream will normally be required to complete the following core of courses:

- German 22.515F1 or W1: Proseminar in literaturwissenschaftlicher Methodologie
- German 22.585F1 or W1: Angewandte Linguistik im Deutschunterricht als Fremdsprache
- German 22.590F1 or W1: Wege der Literaturgeschichte

All master's students choosing the literature stream are also required to undertake a comprehensive examination, based on a departmental reading list of selected texts by major authors. German 22.590 is intended as preparation for this examination. An additional half credit, part of the overall credit requirement, is assigned for the successful completion of the examination while the student is enrolled in German 22.592.

Linguistics Stream
Master's students specializing in German linguistics will normally be required to select and follow one of two alternative program patterns:
- Three full courses (or the equivalent) and a thesis on a problem relevant to the pedagogy of the German language or of German literature
- Four full courses (or the equivalent) and a research essay on a problem relevant to the pedagogy of the German language or of German literature

Within the chosen program pattern, each student in the linguistics stream will normally be required to complete the following core of courses:
- German 22.516F1 or W1: Proseminar in germanistischer Linguistik
- German 22.580T2: Geschichte der deutschen Sprachwissenschaft
- German 22.585F1 or W1: Angewandte Linguistik im Deutschunterricht als Fremdsprache

Graduate Courses*

The following is a list of courses at the graduate level. Please note that *not all* courses are offered *every* year. Students should consult the university and the departmental timetables published early in July for a list of courses offered in 1994-95 and scheduling information.

- German 22.510F1 or W1
Theory and Methodology of German Studies
Fallstudien zur Rezeption fremdsprachlicher Literatur: Die Shakespearerezeption seit dem 18.

* F,W,S indicates term of offering. Courses offered in the fall and winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Jahrhundert. Übersetzungen (Wieland, Schlegel/ Tieck, Fried), Bearbeitungen (Keller, H. Müller, Strauß) und Wirkung Shakespeares in deutscher Literatur vom 18. zum 20. Jahrhundert.

- **German 22.515F1 or W1**
Theory and Methodology of German Studies
Proseminar in literaturwissenschaftlicher Methodologie. Theorie, Text, Interpretation.

- **German 22.516F1 or W1**
Theory and Methodology of German Studies
Proseminar in germanistischer Linguistik. Methoden der Analyse und Beschreibung von Sprache und Kommunikation.

- **German 22.541F1 or W1**
Genres in German Literature
Formen der Kurzprosa, u.a. R.Walser, Kafka, Musil, Brecht.

- **German 22.560T2**
Period Studies
Politischer Diskurs in Textsorten des 19. Jahrhunderts: Lyrik von Uhland bis Holz; Gebrauchstexte (Fichte, Uhland, Marx); Prosa (Goethe, Heine u.a.); Drama (Büchner, Nestroy), Versepos (Heine).

- **German 22.561F1 or W1**
Period Studies
Naturlyrik der Aufklärung. Ästhetische, wissenschaftliche und ökonomische Diskurse in Texten von Brockes, E. v. Kleist, Klopstock, F. L. Stolberg und Hölderlin.

- **German 22.579T2**
Individual Authors
Günter Grass. Literarischer Stil im Kontext von Sprachwandel, Intertextualität, Mündlichkeit und Schriftlichkeit. Individualstil und Geschlechtsrolle. Texte: Öffentliche Rede, Essay, Erzählprosa (von *Katz und Maus* zu *Unkenrufe*) und andere zeitgenössische Prosa.

- **German 22.580T2**
Linguistic Topics
Geschichte der deutschen Sprachwissenschaft. Ursprungstheorien (Herder), anthropologische Sprachtheorie (Humboldt), historische Sprachbeschreibung (Junggrammatiker), Einfluß Saussures auf Grammatikmodelle des Deutschen (Weisgerber, Glinz, Brinkmann; Heringer), Satzsemantik und Valenztheorie (v. Polenz), Sprachkompetenz (Coseriu).

- **German 22.582F1 or W1**
Linguistic Topics
Mittelalterliches Deutsch: Kennzeichen der mittelhochdeutschen Literatursprache.

Morphologische, syntaktische und semantische Strukturen. Ausgewählte Texte aus Epik und Lyrik.

- **German 22.585F1 or W1**
Linguistic Topics
Angewandte Linguistik im Deutschunterricht als Fremdsprache: Lehr- und Lernstrategien im Kontext von Sprachtheorie, Grammatik, Semantik und Pragmatik.

- **German 22.586F1 or W1**
Linguistic Topics
Die Entwicklung des Nationalismus-Diskurses im 19. Jahrhundert. Programmatische Schriften, Reden, Flugblätter, Gedichte und andere relevante Dokumente, die den Nationalstaat forderten beziehungsweise (ab1871) das Reich unterstützten.

- **German 22.590F1 or W1**
Directed Studies
Wege der Literaturgeschichte. Die Entwicklung der deutschen Literatur vom Hohen Mittelalter zum 20. Jahrhundert. Untersuchung ausgewählter Texte sowie theoretische Betrachtungen zur deutschen Literaturgeschichte.

- **German 22.591F1, W1, S1**
Special Topic
Tutorial

- **German 22.592F1, W1, S1**
Comprehensive Examination

- **German 22.598F2, W2, S2**
Research Essay

- **German 22.599F4, W4, S4**
M.A. Thesis

Other Courses

See the *Undergraduate Calendar* for courses at the 400-level which are open, with the approval of the Department, to students in the qualifying-year program and (under the usual restrictions) to master's students.

Courses Not Offered in 1994-95

Genres in German Literature

22.542	Grimmelshausens simplicianische Schriften
22.544	Erzählstrukturen im 20. Jahrhundert
22.546	Formen der Lyrik
22.547	Erzählprosa des 19. Jahrhunderts
22.548	Deutsche Erzählprosa zwischen Reformation und Aufklärung
22.549	Semiotik des Dramas

Department of History

Paterson Hall 432
Telephone: 788-2828
Fax: 788-2819

The Department

Chair of the Department:
R.C. Elwood
Departmental Supervisor of Graduate Studies:
D.L. McDowall
Associate Supervisor:
G.N. Hillmer

The Department of History offers programs of study leading to the degree of Master of Arts in Canadian, American, British, modern French, modern Russian, international (diplomatic), medieval, and European intellectual and social history. It also offers a program of study and research leading to the degree of Doctor of Philosophy in Canadian history and in women's history.

Master of Arts

Admission Requirements
The minimum requirement for admission to the master's program is an honours bachelor's degree (or the equivalent) with at least high honours standing.

The Department offers no qualifying-year program; applicants with a general (pass) degree may be considered for admission into the fourth year of Carleton's honours B.A. program.

Program Requirements
Candidates may follow either a thesis or a non-thesis program, as follows:
- History 24.588 or 24.589: a seminar or tutorial in the historiography of the appropriate country or area (one credit)
- History 24.500: a practicum in the applied uses of history (one credit). Another graduate history seminar may be substituted for this course by students who have had extensive work-related experiences in some historical field
- a graduate history seminar in the student's major field of concentration (one credit)
- *Either* History 24.599: thesis (two credits); *or*
- History 24.598: research essay (one credit) *plus* one additional seminar (one credit), which may be chosen from those offered at the graduate or

400 level by the Department of History, by another department at Carleton University, or by the Department of History at the University of Ottawa
- M.A. students are required to submit thesis/research essay proposals to the graduate supervisor early in their second term of full-time enrolment

Language Requirements
All candidates are required to demonstrate a reading knowledge of a language other than English, the choice to depend upon the field of the candidate's thesis or research. For seminars dealing with sources not in English, a reading knowledge of the appropriate language will be required *before* acceptance into the program. Details may be obtained from the supervisor of graduate studies.

Doctor of Philosophy

Admission Requirements
Applicants with an M.A. degree will be expected to have at least high honours standing. Applicants for the women's history program will be expected to have at least one of their earlier degrees in history.

An applicant with an honours bachelor's degree who has achieved an outstanding academic record and, in addition, exhibits very strong motivation and high promise for advanced research, may be admitted to the Canadian Ph.D. program directly. Such candidates will be required to complete at least fifteen full courses, or the equivalent.

Residence Requirement
- A minimum of three years of full-time study after the B.A. honours degree, or two years after the M.A. degree.

Program Requirements
Candidates will be responsible for three fields: a major field (Canadian or women's history) and two minor fields. In the case of Canadian history majors, at least one of the minor fields must concern American, British, French, Russian or international history. In the case of women's history majors, at least one of the minor fields must concern American, British, Canadian, French, Russian or international history. Women's history majors must declare their area of concentration from among these fields. The second minor field for both majors may be a transnational topic or in a related discipline. In each instance, the minor field should cover approximately one century. Written

examinations will be taken in the two minor fields before the end of the student's second term of study; an oral examination in the major field will be arranged during the student's fourth term. Ph.D. candidates are required to submit a thesis proposal to the graduate supervisor within *three* months of completing their oral examination.

A reading knowledge of French will be required. The language examination will be written early in the first post-M.A. year, and before the candidate is permitted to take the doctoral field examinations. Proven competence in an additional language may be required if it is pertinent to the candidate's program.

Students entering the *Canadian history* program with an honours B.A. will normally complete:

- History 24.588: Historiography of Canada
- History 24.591: Directed Studies in a Canadian Field
- History 24.592: Directed Studies in a Non-Canadian Field
- Two other graduate seminars in their first year

Students entering the second year (that is, the first post-M.A. year) of the Canadian history program will normally be required to follow:

- History 24.688: Historical Theory and Method
- History 24.690: Preparation for a Ph.D. oral examination in Canadian history (equivalent to two full credits)
- *Two* of: History 24.610: Directed Studies in an Aspect of Modern European History; History 24.640: Directed Studies in United States History; History 24.650: Directed Studies in British History; History 24.660: Directed Studies in a Transnational Topic; 24.693 (Women's History Minor); an approved course of studies in a related discipline. At least one of these must be a national history other than Canadian (i.e. 24.610, 24.640 or 24.650)

Students declaring a major field in *women's history* will normally be required to follow:

- History 24.688: Historical Theory and Method
- History 24.692: Directed Studies in Women's History. Preparation for a Ph.D. oral examination in women's history (equivalent to two full credits)
- *Two* of: History 24.610: Directed Studies in an Aspect of Modern European History; History 24.640: Directed Studies in United States History; History 24.650: Directed Studies in British History; History 24.660: Directed Studies in a Transnational Topic; History 24.691 (Canadian History Minor); an approved course of studies in a related discipline. At least one of these must be a national history (i.e. 24.610, 24.640, 24.650 or 24.691)

With other requirements completed, doctoral students will be required to write a thesis on a topic related to Canadian or women's history (five credits).

University of Ottawa
A Carleton University student may take one seminar in the Department of History at the University of Ottawa, with permission of the two departments.

Graduate Courses*

Most, but not all of the graduate seminars (History 24.500 through 24.588 and 24.688) are offered each year, but none is available during the summer. The directed studies and thesis courses (History 24.589 through 24.693) are always offered during the academic year, and are frequently available during the spring and summer terms as well.

Admission to graduate seminars in the Department of History is normally restricted to graduate students in the Department and to others who have successfully completed two full upper-level undergraduate History courses or the equivalent in the general area of the seminar, or who have received permission of the Department.

- History 24.500T2

Practicum in Applied History
Study of the practical uses of history in such fields as teaching and methodology, archival management, museum research, oral history, journal editing, quantitative investigations, and contract research.
D.L. McDowall, B.C. Bickerton

- History 24.502T2

Beginnings of Early Medieval Europe and Near East
Transformation of the later Roman world into the polities of early medieval Europe and Near East. Also offered at the undergraduate level, with different requirements, as 24.402 or 13.402, for which additional credit is precluded.
R.C. Blockley.

- History 24.505T2

Law and Society in Medieval England
J.G. Bellamy.

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* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- History 24.506T2
Medieval Intellectual History
An examination of selected aspects of medieval intellectual history.
Also offered at the undergraduate level, with different requirements, as 24.406, for which additional credit is precluded.
W.R. Laird.

- History 24.516T2
The French Revolution, 1788-1804
A sound reading knowledge of French is required for admission.
Roderick Phillips.

- History 24.525T2
Society and Culture in Canada, 1850-1939
Changes to the structure and values of Canadian societies and their culture in the period of urban-industrial transition.
Members of the Department.

- History 24.526T2
Perspectives on State Formation in Canada
An exploration of selected problems of political history: the construction of official statistics, the language of governments, the invention of nationalisms, the making of political cultures, the autonomy of the state, the practices of bureaucrats, the political role of women, the encounter of the welfare state and families, the political economy of the state, communities and the state.
Also offered at the undergraduate level, with different requirements, as 24.426, for which additional credit is precluded.
Dominique Marshall.

- History 24.529T2
History of Northern Canada
A seminar on the regional history of the Canadian north, including both the provincial and the territorial norths. Topics include native peoples, culture contact, the fur trade economy, and resource frontier development. Canadian attitudes toward the north and the concept of Canada as a "northern nation" are also examined.
Also offered at the undergraduate level, with different requirements, as 24.434, for which additional credit is precluded.
K.M. Abel.

- History 24.530T2
Canadian Immigration and Ethnic History
An analysis of immigration to Canada in the nineteenth and twentieth centuries.
Also offered at the undergraduate level, with different requirements, as 24.424, for which additional credit is precluded.
M.J. Barber.

- History 24.531T2
French Canada Since Confederation
A study of topics relating to the political and social history of French Canada and to problems of cultural duality.
Dominique Marshall.

- History 24.532T2
Ontario in the Nineteenth Century
J.K. Johnson.

- History 24.533T2
Intellectual History of Canada
An intensive examination of selected aspects of Canadian thought from the early nineteenth century to the present.
A.B. McKillop.

- History 24.534T2
Problems of Growth and War in Canada, 1896-1921
D.L. McDowall.

- History 24.535T2
The Canadian Diplomatic Tradition
An examination of the origins, evolution, context and intellectual content of Canadian diplomatic practices and policies.
G.N. Hillmer.

- History 24.536T2
Science and Technology in the Canadian Experience
An examination of the role and relationship of science and technology, including their social and engineering applications, in the Canadian historical experience.
Also offered at the undergraduate level, with different requirements, as 24.421, for which additional credit is precluded.
J.H. Taylor.

- History 24.537T2
The Maritimes in Transition, 1870s to 1920s
A seminar on social and economic themes.
Also offered at the undergraduate level, with different requirements, as 24.422, for which additional credit is precluded.
D.A. Muise or B.C. Bickerton.

- History 24.539T2
Acadian and Quebec Society before 1763
An examination of the main political and social developments in both communities with attention being paid to the history of France during the same period.
Also offered at the undergraduate level, with different requirements, as 24.432, for which additional credit is precluded.
N.E.S. Griffiths.

• History 24.540T2
The Age of the American Revolution, 1730-1815
P.J. King.

• History 24.550T2
Selected Problems in the Political Economy of
Canadian Labour
A study of selected aspects in the history of
Canadian labour with emphasis on the dynamics
of social, economic, political and cultural change in
twentieth-century Canada.
Also offered at the undergraduate level, with differ-
ent requirements, as 24.425, for which additional
credit is precluded.
F.J.K. Griezic.

• History 24.557T2
Community in Early Modern England, 1450-1600
R.B. Goheen.

• History 24.558T2
Culture and Society in Eighteenth- and Nineteenth-
Century Britain: Selected Topics
Deborah Gorham or Mark Phillips.

• History 24.559T2
Women in Nineteenth- and Twentieth-Century
North America and Britain
An examination of the role and image of women in
the context of social and economic development
and of the family in North America and Britain.
M.J. Barber and Deborah Gorham.

• History 24.560T2
Revolutionary Russia, 1898-1921
An examination of various primary sources
available for research on revolutionary Russia.
A sound reading knowledge of Russian is required
for admission.
R.C. Elwood.

• History 24.580T2
Problems in International History
J.L. Black or R.A. Jones.

• History 24.588T2
Historiography of Canada
A seminar, primarily for graduate students in
Canadian history, which examines the trends and
methods of Canadian historical writing and the
influences upon it.
A.B. McKillop.

• History 24.589F2, W2, S2
Historiography
A course of directed studies, leading to an oral
comprehensive examination, in one of the follow-
ing fields:

Modern France
The intensive study of selected problems in the
writing of modern French political and social
history.
Roderick Phillips.
Britain
The intensive study of a range of selected problems
in the writing of sixteenth-century *or* nineteenth-
century English history.
R.B. Goheen, Deborah Gorham, N.E.S. Griffiths.
Modern Russia
Concentrated reading in Russian history and
historiography with emphasis on the nineteenth and
early twentieth centuries.
R.C. Elwood and J.W. Strong.
United States
A course in which the trends and methods of
historical writing on the United States will be
examined.
P.J. King.
International History
A course in which the trends and methods of
historical writing on international history will be
examined.
J.L. Black and R.A. Jones.
Medieval History
Historical method and historiography of an aspect
of the Middle Ages.
J.G. Bellamy or W.R. Laird.
European Intellectual and Social History
Intensive study of a selected topic in the writing of
European intellectual or social history during the
seventeenth, eighteenth or nineteenth centuries.
Roderick Phillips, Mark Phillips or F.A.J. Szabo.

• History 24.591T2, S2
Directed Studies in a Canadian Field
A program of supervised reading and preparation of
written work in an area not covered by an existing
graduate seminar.

• History 24.592T2, S2
Directed Studies in a Non-Canadian Field
(same description as 24.591)

• History 24.593F1, W1, S1
Directed Studies in a Canadian Field
(same description as 24.591)

• History 24.594F1, W1, S1
Directed Studies in a Non-Canadian Field
(same description as 24.591)

• History 24.595F1,W1
Selected Topics in a Canadian Field
A seminar in an area not covered by an existing
graduate course.

• History 24.596F1,W1
Selected Topics in a Non-Canadian Field
(same description as 24.595)

• History 24.598F2, W2, S2
M.A. Research Essay
An examination of an approved topic in Canadian,
American, British, modern French, modern
Russian, international, or medieval history.

• History 24.599F4, W4, S4
M.A. Thesis
A substantial historical investigation. The subject
will be determined in consultation with the
Department, and a supervisor will be assigned.
The candidate will be examined orally after
presenting his/her thesis.

• History 24.610T2, S2
Directed studies in one of the following aspects of
modern European history: modern France
(Roderick Phillips), modern Russia (R.C. Elwood
and J.W. Strong), and international history
(J.L. Black and R.A. Jones).

• History 24.640T2, S2
Directed Studies in United States History
P.J. King and G.F. Goodwin.

• History 24.650T2, S2
Directed Studies in British History
Deborah Gorham, N.E.S. Griffiths or R.B. Goheen.

• History 24.660T2,S2
Directed Studies in a Transnational Topic
Preparation for a minor field examination in an area
not covered in another doctoral course.

• History 24.688T2
Historical Theory and Method
A course primarily for doctoral candidates in
history, offered in alternate years, in which current
trends in historical theory and methodology will
be examined.

• History 24.690F4, W4, S4
Directed Studies in Canadian History
A program of supervised reading with several
instructors in preparation for the Ph.D. oral
examination.

• History 24.691T2
Canadian History Minor
A program of supervised reading in Canadian
history leading to a written comprehensive
examination for doctoral students whose major
field is women's history. Students will attend
History 24.690 (Directed Studies in Canadian
History) in the fall and winter terms.

• History 24.692F4, W4, S4
Directed Studies in Women's History
A program of supervised reading with several
instructors in preparation for the Ph.D. oral
examination in women's history.

• History 24.693T2
Women's History Minor
A program of supervised reading in women's
history leading to a written comprehensive
examination for doctoral students whose
major field is Canadian history. Students will
attend History 24.692 (Directed Studies in
Women's History) in the fall and winter terms.

• History 24.699F, W, S
Ph.D. Thesis

School of Journalism and Communication

St. Patrick's Building 346
Telephone: 788-7404
Fax: 788-6690

The School

Director of the School:
Peter Johansen
Supervisor of Graduate Studies (Journalism):
Dan Pottier

The School of Journalism and Communication offers courses leading to the degree of Master of Journalism. For a description of its degree of Master of Arts in Communication, see page 98. The emphasis in the M.J. program is on advanced professional education for those who are or intend to become practising journalists in the news media. In practical terms, this entails both the polishing of professional journalistic skills to a high level of proficiency and advanced education in a related field of study. Provision is made also for students who wish to undertake research in journalism and mass media.

Following a common first year of professional coursework, students in the master's program will choose one of three areas of concentration in their second year of study:

Specialized Print Reporting
At present specializations are offered in the fields of politics/public administration, international affairs and economics/business. Others may be added as resources come available.

Broadcast Journalism
The focus of this specialty will be the study of advanced techniques in reporting, writing and producing programs for the broadcast media.

Journalism Studies
This program is designed for applicants who have mastered the skills of reporting and writing for the news media but who wish to spend a year studying their craft and/or the news industry. This specialty encompasses a number of topics, which include the role of the media in society as it is conceived by selected social and political theorists, communications law, politics and the media, the economics of the media and journalism history.

Carleton's School of Journalism and Communication is uniquely situated for advanced journalism study. It offers ready access to many of the people and institutions that most directly influence Canadian affairs: Parliament, federal government departments and agencies, embassies, business and labour organizations, and major economic and cultural institutions.

Master of Journalism

Admission Requirements
The Master of Journalism program comprises twenty half courses (or the equivalent). Most applicants will be admitted to the first year of a two-year course of study, but some may qualify for admission directly to the second year (see below). An admissions committee, including the supervisor of graduate studies, will determine the admissions qualifications of each applicant.

Admission will be selective. Admission will not be guaranteed to all who meet the published minimum requirements, as there are many more qualified applicants each year than there are available spaces.

A student who holds a bachelor's or master's degree from a recognized university in a field other than journalism may be admitted to the first year of study if he or she achieved at least high honours standing. Such students who complete the core first year, outlined below, and meet the requirements of the Faculty of Graduate Studies and Research (see page 24) may proceed to second year.

Applicants who have a three-year (pass) journalism degree with high honours standing may be admitted to a first year made up largely of approved courses from the Faculties of Arts and Social Sciences. Such students may proceed to the second year of study if they have achieved high honours standing.

A limited number of spaces will be made available for direct admission to the second year of the M.J. program. Students must normally possess one of the following qualifications to be considered for this advanced admission: a B.J. (Honours) or equivalent with high second-class standing, *or* a degree in another discipline from a recognized university plus at least five years of professional experience in journalism, *or* long and distinguished professional experience in journalism. Students with suitable professional qualifications but no degree may occasionally be admitted to a program in which they take a required number of undergraduate courses in addition to the M.J. program.

Application is made on forms available from the School of Journalism and Communication. Students applying for the first year of the program are advised to apply by June 1 as enrolment in the School is limited. All applications received after June 1 will normally be considered only for entry into the program in the year following.

As a condition for graduation, all students are required to have a minimum of four months of practical experience in the media, and a working knowledge of a second language, preferably French.

Program Requirements
First Year
Candidates admitted to the first year of the Master of Journalism program must complete the following courses before proceeding to the second year of study:

- Journalism 28.500
- Journalism 28.520
- Journalism 28.522
- Journalism 28.524
- Journalism 28.535
- Journalism 28.536
- Journalism 28.541
- Journalism 28.321

First year M.J. candidates may be considered for advanced standing in certain of the above required courses, but in such cases will be required to replace waived courses with approved options.

Second Year
Credits will be determined according to the stream pursued:

Specialized Print Reporting
(i) Journalism 28.560
(ii) Journalism 28.570
(iii) Journalism 28.575**
(iv) Journalism 28.598**
(v) At least one approved full course or two approved half courses in the student's area of specialization.
**Under special circumstances, and with departmental approval, a student could replace items (iii) and (iv) above with a two-credit M.J. thesis, 28.599.

Broadcast Journalism
(i) Journalism 28.560
(ii) Journalism 28.572
(iii) Journalism 28.575**
(iv) Journalism 28.598**
(v) At least one approved full course or two approved half courses in the student's area of specialization.
**Under special circumstances, and with departmental approval, a student could replace items (iii) and (iv) above with a two-credit M.J. thesis, 28.599.

Journalism Studies
(i) Journalism 28.560
(ii) At least one approved full course or equivalent in a field other than journalism but related to the study of journalism (eg., 47.403, 27.410*, 27.412*, 27.430*, 27.432*)
(iii) One approved full course or equivalent from Journalism 28.580, 28.588, 28.589, 28.590, 28.591
(iv) Journalism 28.599

* At the undergraduate level denotes a half-credit course

Academic Standing
All candidates are required to obtain a grade of B– or better in each course in the program. A candidate may, with the recommendation of the School and the approval of the Dean of the Faculty of Graduate Studies and Research, be allowed a grade of C+ in one full course or each of two half courses.

Full-time students in a ten-credit M.J. program are advised that their thesis or research essay proposal must be formally approved within eighteen months of initial registration. Students in a five-credit program must have the proposal formally approved by the middle of their second term of full-time registration. Due dates for part-time students will be adjusted accordingly. Students failing to file a proposal may not be permitted to register in subsequent terms until this requirement has been met. Approval of proposals shall be the responsibility of a thesis committee appointed by the Director of the School.

Students are advised to consult the general regulations section of this calendar for other regulations relating to academic standing.

Graduate Courses*

First Year:
- Journalism 28.500F1 or W1
Journalism and Society I
An examination of the conditions under which genuine communication is possible in a modern democratic society, with special attention to patterns of journalistic practice, media ownership and governmental regulation in Canada, Britain and the United States. Emphasis is placed on certain traditional texts as well as current research studies related to journalism and communication.

* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- Journalism 28.520F2
Print Journalism Laboratory
A laboratory course in basic reporting and editing techniques, followed by application in the print media.

- Journalism 28.522W2
Broadcast Journalism Laboratory
A laboratory course in reporting and editing in the broadcast media.

- Journalism 28.524W1
Depth Reporting
Under the supervision of a faculty member, students will select a public affairs topic of current interest and will research and write a series of interpretive newspaper articles on that subject area. Research and interviewing techniques will be explored as will techniques of writing longer news articles. Seminars will be a combination of faculty instruction and class discussion based on the students' written work.

- Journalism 28.535F1 or W1
Perspectives on Modern Society
A seminar course examining texts from the social sciences, philosophy, literature and journalism for the contribution they make to an understanding of issues facing modern industrial society.

- Journalism 28.536F1 or W1
Public Issues
A seminar course examining literature and other sources in an attempt to understand continuing and emerging political, social and economic problems in Canada and elsewhere.

- Journalism 28.541F1 or W1
Journalism Law
The purpose of this course is to prepare journalists to function comfortably within the legal and ethical guidelines governing their occupation. The course also aims to help them avoid the large errors in reporting legal matters. Topics studied and discussed include: the difference between civil and criminal law; contempt of court; free press, fair trial; revealing of sources; civil defamation; criminal libel; obscenity; copyright; privacy; government secrecy; advertising law.

Second Year:
- Journalism 28.560T2
Journalism and Society II
This course involves an examination of the practices and problems of journalism, and the role of journalism in modern society. Students will be asked to read texts in which journalists examine their craft and in which non-journalists analyze and comment on the manner in which journalism and communication systems are organized in modern society. The course seeks to integrate the analysis of journalism practice into general theories of media and society.

- Journalism 28.570T2
Specialized Print Reporting
This course attempts, through a combination of seminars and individual or small-group tutorials, to integrate advanced journalistic skills with knowledge gained in specialized areas such as politics, international affairs, and economics. Students will study approaches to and problems in reporting in specialized areas, and work with senior professionals to research, report and write interpretive articles in those specialities.

- Journalism 28.572T2
Television Journalism
Students will be asked to analyze and, as resources permit, report, write and produce news and public affairs television programs.

- Journalism 28.575T2
Professional Practices
A senior seminar and practicum for second-year students in the specialized print reporting and broadcasting streams. Elements of the course include story analysis, publishing/broadcasting practices, ethical practices, management practices, language analysis, operation and practices of news services.

- Journalism 28.580F1 or W1
Survey Methods for Journalists
An examination of basic research design and data collection with emphasis on problems of interpretation.

- Journalism 28.588F1
Directed Readings
Students, working under faculty direction, will undertake an intensive reading schedule in order to pursue a subject area of particular interest.

- Journalism 28.589W1
Directed Research
Students, working under faculty direction, will develop and undertake a research project in order to pursue a subject area of particular interest.

- Journalism 28.590T2, S2
Directed Studies
Reading and research tutorials.

- Journalism 28.591F1, W1, S1
Directed Studies
Reading and research tutorials.

• Journalism 28.598F2, W2, S2
M.J. Research Project
The student will complete a substantial piece of
public affairs journalism in print or, if resources
permit, in radio or television; *or* a research project
on the mass media; *or* a major contribution to
journalism education through the production of a
document on an aspect of journalism practice.
Students in the specialized reporting stream will be
expected to write on public affairs; broadcasting
students will be expected to examine problems in
broadcast journalism or, if resources permit, may
be given an opportunity to submit a completed work
on film or video or in radio.

• Journalism 28.599F4, W4, S4
M.J. Thesis
To fulfil the requirements of this two-credit thesis
course, students must produce a major piece of
journalistic research or complete an academic thesis
in the area of journalism studies.

Department of Linguistics and Applied Language Studies

Paterson Hall 249
Telephone: 788-2802
Fax: 788-2642

The Department

Chair of the Department:
William Cowan
Departmental Supervisor of Graduate Studies:
Richard Darville

The Department of Linguistics and Applied Language Studies offers programs of study leading to the degree of Master of Arts in Applied Language Studies. Applied language studies may be distinguished by their focus on language learning, especially the acquisition of literacy and/or second languages, in a variety of contexts.

The program is geared largely towards practitioners in the field, and is aimed at enhancing their understanding of:
- discourse processes and social contexts for language use
- first and/or second language acquisition and development
- educational contexts for and testing of such acquisition

Concentration is possible in one of the following three fields:
- English as a second language
- the acquisition and development of writing abilities
- adult literacy

In addition, individual programs may be drawn up for students who are interested in the connection among any of these three fields.

Additional information may be obtained by consulting the departmental supervisor of graduate studies.

Qualifying-Year Program

Applicants who hold a pass degree with honours standing (at least B overall) may be admitted to the qualifying-year program. Normally, these students will be required to complete five full courses (or the equivalent) in accordance with the advice of the graduate supervisor. At the end of the qualifying-year program, the department will determine the student's eligibility to enter the master's program.

Master of Arts

Admission Requirements
The minimum admission requirement for the master's program is an honours B.A. (or the equivalent) in Applied Linguistics with at least high honours standing (normally B+ or better in linguistics, B– or better overall) or a pass B.A. in a related discipline with the equivalent of the Certificate in Teaching English as a Second Language or the Certificate in English Language and Composition completed with at least high honours standing (B+ in courses taken for the Certificate).

Program Requirements
Students will establish their programs in consultation with an adviser from the department.

Each candidate will select one of the following program paths:
- Linguistics 29.552: Inquiry Strategies in Applied Language Studies, Linguistics 29.501: Directions in Applied Language Studies, plus two full courses (or the equivalent) from the department's graduate listing and a master's thesis (29.599)
- Linguistics 29.552: Inquiry Strategies in Applied Language Studies, Linguistics 29.501: Directions in Applied Language Studies, plus three full courses (or the equivalent) from the department's graduate listing and a research essay (29.598)

Linguistics 29.501 is normally to be taken in the first fall term after admission to the program. Permission may be granted for enrolment in one course offered in another department.

Graduate students may take the equivalent of one full-credit course at the senior undergraduate level, with the permission of the departmental adviser.

Academic Standing
A standing of B– or better must be obtained in each course counted towards the master's degree.

Graduate Courses*

The following is a list of all courses at the graduate level. *Please note that not all courses are offered every year*. Students should consult the university and departmental timetables published early in July for a list of courses offered in 1994-95 and scheduling information.

• Linguistics 29.501F1, W1, S1
Directions in Applied Language Studies
A survey of current research directions in applied language studies and an introduction to ongoing research in the Department. The course introduces students to the scope of theory and practice in the field.

• Linguistics 29.521F1, W1, S1
The Second Language Classroom
Research in second language classroom; methods for evaluating classroom practice and materials.

• Linguistics 29.522F1, W1, S1
Curriculum Design in ESL
Current theory and practice in ESL curriculum design in the light of recent research in linguistics, psycholinguistics, sociolinguistics and language acquisition studies.

• Linguistics 29.541F1, W1, S1
Pragmatics
Aspects of speech act theory and linguistic pragmatics as applied to language learning, to the development of communicative competence, and to specific forms of discursive interaction.

• Linguistics 29.543F1, W1, S1
The Mother Tongue Classroom
Studies of the uses of language in mother tongue classrooms. Methods for evaluating the linguistic components and effectiveness of classroom practices and materials.

• Linguistics 29.545F1, W1, S1
Written Language, Representation and Cognition
Language and thought: social formation of mind and language; written and spoken discourse compared; models and taxonomies of written discourse; modes (narrative, exposition, argument) in traditional rhetoric and contemporary research; concepts of function and levels of abstracting. Before 1994-95 course 29.545 was offered as 29.563.

• Linguistics 29.551F1, W1, S1
Language Testing
Methods for the development of tests. Analytic techniques, including classical and IRT methods. Research in test-taking and test evaluation.

• Linguistics 29.552F1, W1, S1
Inquiry Strategies in Applied Language Studies
A consideration of various approaches to the design of studies and the collection and analysis of data. Naturalistic and quasi-experimental methods will be discussed. The role of statistics in disciplined inquiry, including an introduction to elementary procedures.

• Linguistics 29.553F1, W1, S1
Statistics for Applied Language Studies
Statistics and their application in both naturalistic and quasi-experimental inquiry in applied language studies. Exploratory and confirmatory approaches will be covered.

• Linguistics 29.554F1, W1, S1
Evaluation in Applied Language Programs
An examination of various evaluation paradigms and their application to problems of program and curriculum in applied language settings. The connections among and differences between research and evaluation models of inquiry.

• Linguistics 29.561F1, W1, S1
Language Acquisition
Current models of first and second language acquisition, with emphasis on empirical studies.

• Linguistics 29.564F1, W1, S1
Aspects of First-Language Development
Empirical study of the development of syntax and the expansion of communicative competence in the mother tongue during the years of formal education. Pedagogical implications.

• Linguistics 29.565F1, W1, S1
Writing Research and Theory: Overview of Recent and Current Approaches
Overview of trends and directions in composition research and theory since the 1970s, from the reinvention of rhetorical theory, to the application of cognitive models in research on composing, and the more recent importation of social constructivist paradigms.

• Linguistics 29.566F1, W1, S1
Adult Literacy Acquisition
Studies of adult literacy learners. Theories of adult learning. Relations between literacy and other linguistic abilities. Pedagogical implications.

* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• Linguistics 29.571F1, W1, S1
Linguistic Aspects of Canadian Bilingualism
The sociolinguistics and psycholinguistics of
different kinds of bilingualism in Canada, with
special emphasis on French-English bilingualism and
English-heritage language bilingualism.
Prerequisite: Honours courses in linguistics or
permission of the Department.

• Linguistics 29.573F1, W1, S1
Academic and Workplace Genres
Overview of current reconceptualizations of genre
as social action; recent research into the nature of
school-based, professional, and workplace discourse;
issues relating to genre acquisition and pedagogy.

• Linguistics 29.574F1, W1, S1
Research in Adult Literacy
Studies in adult reading. Methods of identifying
adult reading needs. Sociolinguistics of adult
reading.

• Linguistics 29.576F1, W1, S1
Writing Research and Theory: Social and Cultural
Dimensions
Recent research in the social and cultural dimensions
of learning to read and write; the uses and impact of
written discourse in social contexts; writing in
modern societies; the impact of electronic technology.
Before 1994-95 course 29.576 was offered as
29.572.

• Linguistics 29.581F1, W1, S1
Native Languages of Canada
A tutorial to study the descriptive, historical, and
anthropological aspects of selected native languages
of Canada, among them Cree and Iroquois.
Prerequisite: Honours courses in linguistics or
permission of the Department.

• Linguistics 29.592F1, W1, S1
Tutorial in Applied Language Studies
A one-term tutorial to study applications of linguistics
in such areas as first-language education and second-
language teaching.

• Linguistics 29.595F1, W1, S1
Special Topics in Applied Language Studies
Exploration of a topic from current research in
applied language studies. Students should check
with the department regarding the topic addressed
in any term.

• Linguistics 29.597T2
Tutorial in Applied Language Studies
A two-term tutorial to study applications of linguistics
in such areas as first-language education and second-
language teaching.

• Linguistics 29.598F2, W2, S2
Research Essay

• Linguistics 29.599F4, W4, S4
Master's Thesis

Mass Communication

St. Patrick's Building 310
Telephone: 788-7408
Fax: 788-6690

The Program

Associate Director:
Paul Attallah
Supervisor of Graduate Studies:
E.M. Saunders

The Mass Communication program of the School
of Journalism and Communication offers a program
of studies leading to a Master of Arts degree in
Communication. Courses covering four areas of
concentration are offered:
- the history of communication and media systems
- communication/information technologies and
  society
- communication and social relations
- communication policy and political economy
Additional information may be obtained by
consulting the supervisor of graduate studies.

Qualifying-Year Program

Applicants who lack an honours degree, but have a
pass degree with honours standing (a minimum B
standing overall) may be considered for admission
to a qualifying-year program. Students who complete
the qualifying year with high honours standing may
be considered for admission to the master's
program in the following year. Refer to the general
regulations section of this calendar for regulations
governing the qualifying year.

Master of Arts

Admission Requirements
The minimum requirement for admission to the
master's program is an honours bachelor's degree
or the equivalent with high honours standing in
communication or a related discipline. Related
disciplines may include sociology, political science,
film studies and Canadian studies.
    Applicants without a background in communication
studies may be required to take certain designated
courses from the undergraduate mass communication
program in addition to their regular program.

Possession of the minimum entrance standing is not
in itself, however, an assurance of admission into
the program.

Program Requirements
Each student in consultation with the supervisor of
graduate studies will be required to follow a thesis
or a non-thesis program for a total of five full
credits. Two of the four areas of concentration must
be chosen.
    In selecting their program of studies all students
will be required to take Communication 27.511:
Foundations of Communication Studies. Students
may take one optional course (one full credit) outside
the program, with permission of the supervisor of
graduate studies.
    All master's students are required to complete:
- 27.511: Foundations of Communication Studies
- two half credits selected from:
  27.521: History of Social Communication
  27.523: Communication, Technology and Society
  27.525: Communication and Social Relations
  27.531: Communication Institutions, Cultural
  Industries and State Policy
- a thesis (two credits) and two half credits from
  the list of optional courses below,
  or
  a research essay (one credit) and four half credits
  chosen from the list of optional courses

Optional Courses
- 27.555: Communication Media
- 27.556: International Communication
- 27.557: History of Canadian Broadcasting
- 27.558: Mass, Public, Audience
- 27.559: Media, Culture and Gender
- 27.565: Special Topics in Communication
  Research
- 27.589: Directed Research
- 27.590: Directed Studies

Note: *Students may take up to one credit outside the
program with permission of the supervisor of
graduate studies.*

Academic Standing
A standing of B– or better must be obtained in each
course counted towards the master's degree.

Graduate Courses*

The following is a list of all courses in mass communication at the graduate level. *Please note that not all courses are offered every year.* Students should consult the university and school timetables published early in July.

• Communication 27.511T2
Foundations of Communication Studies
This course undertakes an examination of the historical emergence of communication studies in North America. It examines specific problematics and theoretical paradigms as they relate to their contexts of emergence and their underlying logics. It will deal with the methodological debates which have occurred between various schools over the competing definitions of communication, and over the broader question of the centrality of communication to society.

• Communication 27.521F1 or W1
History of Social Communication
An examination of how major changes in the institutions and technologies of communication have affected the development of western society from the medieval period to the present day. Consideration will be given to relevant theoretical studies on communication as well as to selected works on social and cultural history.

• Communication 27.523F1 or W1
Communication Technology and Society
The course examines the social and cultural significance of communication and information technology (e.g. computers, television, telecommunication). It examines how these technologies influence and are influenced by major social institutions (e.g. business, government, entertainment) and by cultural practices.

• Communication 27.525F1 or W1
Communication and Social Relations
The course provides a detailed analysis of communication processes and practices and the way in which they produce and reproduce the social contexts and relations of gender, age, ethnicity, and political and other socio-cultural attachments. The course explores major theoretical contributions to the understanding of this relationship and considers a number of specific case studies and empirical research findings.

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* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• Communication 27.531F1 or W1
Communication Institutions, Cultural Industries and State Policy
The course examines the economic and industrial organization of communication and cultural production in Canada. It introduces students to political economy analysis and institutional analysis of the communication and cultural industries. The course covers the historical development of communication institutions and enterprises, the governing logics and mechanisms of operation, and the role of state agencies in this sector. The course will, among other things, study the notions of market and mandate, labour and leisure, and consumption and choice. The course also considers the state, both as an actor and as a field of intervention in the socio-economic development of communication, and the processes of policy making as they concern contemporary Canadian debates.

• Communication 27.555F1 or W1
Communication Media
A research seminar which focuses critically upon one of the communication media (such as radio, television, film, telecommunications, publishing, etc.) with a view to understanding its history, forms and genres, and social uses.

• Communication 27.556F1 or W1
International Communication
This course addresses the institutions, processes and policies in international communication. It does so by discussing the development of global news, mass entertainment, advertising and telecommunication systems. The course examines public and private international organizations that create media and make international communication policy. It addresses critical issues including the relationship between the freedom to communicate and national sovereignty, the role of international media coverage in world politics, and the impact of global media technologies on traditional cultures.

• Communication 27.557F1 or W1
History of Canadian Broadcasting
An examination of the development of public and private radio and television broadcasting in Canada in both English and French from the 1920s to the present day. Consideration will be given to changes in the structure and regulation of the Canadian broadcasting system; the evolution of broadcast technology; developments within areas of programming such as news, public affairs, drama, women's interests, and children's programs; the role of special services such as the CBC Northern Service and Radio Canada International; and controversies such as the debate over Canadian content regulations. Each student will be expected

to write a seminar paper based in part on original research using primary source materials such as archival documents, oral history interviews, and extant program tapes.

• Communication 27.558F1 or W1
Mass, Public, Audience
This course examines the emergence and evolution of conceptions of modern social organization through the key concepts of mass, public and audience. It looks at how and why shifts in the understanding of social organization occur, how and why these shifts are theorized, and the implications for communication study.

• Communication 27.559F1 or W1
Media, Culture and Gender
This course examines the various theoretical positions which underlie the debates on the production and reproduction of gender relations through communication processes and communication institutions. It addresses current research issues in the feminist debates on culture and communication and explores the possibilities for a feminist politics of communication.

• Communication 27.565F1 or W1
Special Topics in Communication Research
The course considers a variety of research protocols and procedures which may include: research organization; documentary research techniques; strategies in textual analysis, including content analysis and thematic analysis; qualitative techniques, including interviewing, observation and ethnography; quantitative methods, including questionnaires, coding procedures, and statistical analysis; and writing organization and style.

• Communication 27.589F1, W1, S1
Directed Research
The student, working under faculty direction, will develop and undertake a research project in order to study a particular subject area.

• Communication 27.590F1, W1, S1
Directed Studies
Tutorials or directed readings in selected areas of communication. The student will present papers as the basis for discussion with the tutor.

• Communication 27.598F2, W2, S2
Research Essay

• Communication 27.599F4, W4, S4
M.A. Thesis

Selection of Courses in Related Disciplines

In addition to courses offered by the Mass Communication program the following courses may, with the prior approval of the supervisor of graduate studies, be used to complete program requirements. This list is not exclusive and is subject to change. Students should be aware that enrolment in these courses may be limited and that registration may be conditional upon obtaining prior approval of the department concerned.

Note: *It is the responsibility of the student to ensure that permission is obtained from the appropriate department prior to registering in any of the department's courses.*

Canadian Studies
12.510   Northern and Native Issues
12.520   Women's Studies
12.530   Canadian Culture and Cultural Policy

Economics
43.533   Regulation and Public Enterprise

Film Studies
19.528   Canadian Cinema

Geography
45.543   Selected Concepts in Cultural Geography

Journalism and Communication
28.500   Journalism and Society I
28.560   Journalism and Society II

Political Economy
44.500   Theories of Political Economy
44.501   The Methodology of Political Economy

Political Science
47.403   Politics and the Media
47.504   Policy Making in Canada
47.541   Canadian Public Administration and
         Policy Analysis

Sociology
53.525   Canadian Society
53.536   Cultural Studies
53.538   Feminist Analyses
53.539   Cultural Theory
53.554   Selected Problems in Political Economy I
53.555   Selected Problems in Political Economy II

School for Studies in Art and Culture
Music

Loeb Building A911
Telephone: 788-5770
Fax: 788-4467

The School
St. Patrick's Building 427

Director:
John Shepherd
Assistant Director (Music):
Elaine Keillor

Music offers courses at the graduate level in the history of Canadian music and related fields, in cooperation with the School of Canadian Studies. Full use will be made of the resources of the National Library, the Public Archives, and the National Museum of Civilization.

Dr. Elaine Keillor is lecturer in Canadian music with Dr. Helmut Kallmann (former Chief Music Librarian, National Library) as Adjunct Professor.

Graduate Courses*

• Music 30.501W1
Theories of Music as Culture
This course provides a critical survey of major theories on the relationship between music and culture. Particular attention is paid to the way in which work in musicology, ethnomusicology, culture theory, feminism, semiotics, structuralism, poststructuralism and psychoanalytic theory has been applied to the problem of understanding the culture-specific character of sound in music.
Prerequisite: Permission of the School for Studies in Art and Culture (Music).

• Music 30.510T2
History of Canadian Music I
Selected aspects of Canadian music from 1600 to the present; liturgical music; social and economic conditions of Canadian musical life; regional studies; individual composers.
Prerequisite: Permission of the School for Studies in Art and Culture (Music).

• Music 30.511F1
History of Canadian Music II
Anglo- and Franco-folk music traditions in Canada, past and present.
Prerequisite: Permission of the School for Studies in Art and Culture (Music).

• Music 30.512W1
History of Canadian Music III
The music of various ethnic minorities in Canada with special emphasis on Inuit and native traditions.
Prerequisite: Permission of the School for Studies in Art and Culture (Music).

• Music 30.515F1
History of Canadian Music IV
A survey of the history of French-Canadian popular music from the beginnings of Nouvelle France to the present. Topics to be covered include folk music of the seventeenth, eighteenth and nineteenth centuries, salon music, political song, and the growth of mass disseminated popular music. Special attention will be paid to the social and political contexts of music making, in particular the identity of popular music with aspirations of nationalism in the Province of Quebec during the 1950s, 1960s and 1970s.
Prerequisites: Permission of the School for Studies in Art and Culture (Music). A good reading ability in French is essential.

* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Department of Philosophy

Dunton Tower 2123
Telephone: 788-2110

The Department

Chair of the Department:
John Leyden
Supervisor of Graduate Studies:
Marvin Glass

The Department of Philosophy offers programs of
study leading to the degree of Master of Arts.

Qualifying-Year Program

Applicants who do not hold an honours degree (or
the equivalent) will be required to register in a
qualifying-year program before proceeding to the
master's program.

The regulations governing the qualifying year are
outlined in the general section of this calendar.

Master of Arts

Admission Requirements
The minimum requirement for admission to the
master's program is an honours B.A. degree (or the
equivalent) in Philosophy, with at least B+ standing
or the equivalent.

Qualifying-year and M.A. applicants from an
institution other than Carleton University must submit
two papers.

Program Requirements
The specific program requirements for master's
candidates are the following:
- Philosophy 32.580 Graduate Seminar
- A thesis equivalent to two full-course credits,
  which must be defended at an oral examination;
  or a research essay equivalent to one full-course
  credit
- Four half-course credits (or *six* in the case of
  students following the research essay option), a
  minimum of two by tutorial, in at least three of
  the following study areas: studies in the history
  of philosophy; studies in the work of an individual
  philosopher; studies in logic, epistemology, or
  metaphysics; studies in selected problems in
  philosophy.

Guidelines for Completion of M.A. Degree in Philosophy
Full-time students enrolled in the five course M.A.
program are expected to complete Philosophy
32.580 and four half-credit courses by the end of
the second term of study. The thesis or research
essay approval form should be submitted by the end
of the fourth week of the third term of study. Those
students choosing the research essay option should
complete two additional half-credit courses by the
end of the third term of study. All full-time students
are expected to submit the thesis or research essay
by the end of the fourth term of study.

Part-time students enrolled in the five course
M.A. program are expected to complete Philosophy
32.580 and four half-credit courses by the end of
the third year of study. The thesis or research essay
approval form should be submitted by the end of
the second month of the fourth year of study. Those
students choosing the research essay option should
complete two additional half-credit courses by the
end of the fourth year of study. All part-time students
are expected to submit the thesis or research essay
by the end of the fifth year of study.

Other Courses
A maximum of one full course (or the equivalent)
may be selected from those offered at the 400 level,
or in a related field, or at another university.

Each year, the department offers 400-level
undergraduate half courses, which are open to students
in the qualifying year and, with permission, to students
in the M.A. program. For courses offered in 1994-95,
please consult the *Undergraduate Calendar*.

Graduate Courses*

The following graduate courses are open to students
in the M.A. program and, with permission, to students
in the qualifying-year program. In tutorial courses,
at least five two-hour tutorial sessions will be required.

*Please note that not all courses are offered every
year.* Students should consult the university and
departmental timetables published early in July for
a list of courses offered in 1994-95 and scheduling
information.

Tutorial Courses

• Philosophy 32.504F1
Tutorial in the History of Philosophy I
Detailed study of a period or issue in the history of
philosophy.

• Philosophy 32.505W1
Tutorial in the History of Philosophy II
Detailed study of a period or issue in the history of
philosophy.

• Philosophy 32.514F1
Tutorial in the Work of an Individual Philosopher I
A critical and systematic study of the work of an in-
dividual philosopher.

• Philosophy 32.515W1
Tutorial in the Work of an Individual Philosopher II
A critical and systematic study of the work of an in-
dividual philosopher.

• Philosophy 32.524F1
Tutorial in Logic, Epistemology, or Metaphysics I
An attempt to find a solution to a specific problem
in logic, epistemology, or metaphysics.

• Philosophy 32.525W1
Tutorial in Logic, Epistemology, or Metaphysics II
An attempt to find a solution to a specific problem
in logic, epistemology, or metaphysics.

• Philosophy 32.534F1
Tutorial in Selected Problems of Philosophy I
An attempt to find a solution to a specific problem
in some area other than logic, epistemology, or
metaphysics.

• Philosophy 32.535W1
Tutorial in Selected Problems of Philosophy II
An attempt to find a solution to a specific problem
in some area other than logic, epistemology, or
metaphysics.

Seminar Courses

• Philosophy 32.510F1
Advanced Problems in Legal Philosophy
Studies in legal theory and analyses of law advanced
by Hart, Dworkin and others, and legal concepts:
for example, principles, rights, duties, liability, etc.

Precise course content will vary from year to year
and will be announced at the beginning of the term.
Prerequisites: Philosophy 32.311 and 32.312
(Law 51.311 and 51.312), or permission of the
relevant department.
(Also offered as Law 51.510)

• Philosophy 32.520F1 or W1
Seminar in Philosophy of Mind and/or
Philosophical Semantics
A detailed study of an issue or the work of selected
philosophers in the general area of philosophy of
mind and/or philosophical semantics.

• Philosophy 32.530F1 or W1
Seminar in Value Theory
A detailed study of an issue or the work of selected
philosophers in the general area of value theory.

• Philosophy 32.540F1 or W1
Seminar in German Idealism, Its Influence and/or
Reactions to It
A detailed study of an issue or the work of selected
philosophers in the general area of German idealism,
its influence and/or reactions to it.

• Philosophy 32.580T2
Graduate Seminar
The first term will be devoted to a single issue or
group of interrelated issues. In the second term, a
variety of topics will be discussed. Issues covered
in this course will vary from year to year.

• Philosophy 32.598F2,W2,S2
Research Essay

• Philosophy 32.599F4,W4,S4
M.A. Thesis

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* F,W,S indicates term of offering. Courses offered in the fall *and*
winter will be followed by T.
The number following the letter indicates the credit weight of the
course: 1 denotes a half-course credit, 2 denotes a full-course credit,
etc.

Department of Religion

Dunton Tower 2121
Telephone: 788-2100

The Department

Chair of the Department:
J.G. Ramisch
Departmental Supervisor of Graduate Studies:
J.P. Dourley

The Department of Religion offers programs of
study leading to the degree of the Master of Arts.

Master of Arts

Admission Requirements

The minimum requirement for admission to the
master's program is an honours bachelor's degree
in religion (or the equivalent) with at least high
honours standing.

Applicants who do not hold an honours degree in
religion (or the equivalent) will be required to
register in a qualifying-year program before proceeding
to the master's program.

The regulations governing the qualifying year are
outlined in the general section of this calendar.

Program Requirements

The student will choose a program of study
concentrating on one of the following major areas:
comparative religion, with special emphasis on one
of the major traditions; biblical and ancient near eastern
studies; and modern religious thought and culture.
Candidates must follow either a thesis or non-thesis
program. The specific requirements are as follows:

Thesis Program
- Seminars equivalent to one full course in major area
- Seminars equivalent to one full course, selected
  from one or both of the other areas
- Tutorial in major area for one-course credit
- Thesis (equivalent to two full courses) on a topic
  in major area, which must be defended at an oral
  examination

Non-Thesis Program
- Seminars equivalent to three full courses; of
  these, at least two half-course seminars must be
  from the major area, at least two from a second
  area, and at least one from the remaining area
- Comprehensive reading course in major area
- One additional course in major area

The student's program will be worked out in
consultation with, and with the approval of, the
department's supervisor of graduate studies and its
committee on graduate studies. The prescribed
program will take into account the student's
background and special interests, as well as the
research interests and competence of the staff.

Deadlines

Thesis Proposal: In the case of the thesis program,
full-time students will normally submit their thesis
proposal to the thesis proposal board by the end of
the first month of their second term in the M.A.
program.

Thesis: The candidate will inform the thesis
supervisor two weeks in advance of the date on
which he intends to submit copies of his thesis. The
date of the defence will be set upon submission of
the thesis and will take place no sooner than two
weeks after the date of submission. This assumes a
minimum of four weeks between the candidate's
statement of intent and the defence.

Language Requirements

The student will be required to acquire, or to
demonstrate that he/she already has, a reading
knowledge of whatever language is essential to
his/her research.

Students are advised to consult the departmental
handbook for further regulations.

Graduate Courses*

- Religion 34.512T2, S2
Tutorial in Comparative Religion

- Religion 34.513F1, W1, S1
Directed Studies in Comparative Religion
Seminar for additional study in this area.

- Religion 34.520F1
Seminar in Biblical and Ancient Near Eastern
Studies
Topic for 1994-95: Critical Theory and the Bible
An exploration of trends in biblical scholarship
influenced by current literary theory and the
philosophy of language. Selected biblical texts

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winter will be followed by T.
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etc.

from Deuteronomy through 2 Kings are interpreted according to these new approaches.
Also offered at the undergraduate level, with different requirements, as 34.486A, for which additional credit is precluded.
(Also offered as Comparative Literary Studies 17.582)

• Religion 34.521W1
Seminar in Biblical and Ancient Near Eastern Studies
Topic for 1994-95: Jews and Christians in the Roman World
A study of the political, social and cultural context of early Judaism and early Christianity. Emphasis will be placed on how the Romans viewed Jews and Christians and how Jews and Christians accommodated themselves to Roman rule.
Also offered at the undergraduate level, with different requirements, as 34.486B, for which additional credit is precluded.

• Religion 34.522T2,S2
Tutorial in Biblical and Ancient Near Eastern Studies

• Religion 34.523F1, W1, S1
Directed Studies in Biblical and Ancient Near Eastern Studies
Seminar for additional study in this area.

• Religion 34.530F1
Seminar in Modern Religious Thought and Culture
Topic for 1994-95: The Impact of Feminist Research on the Study of Religion
The seminar will explore the diverse contributions feminist theory and practice have made to the study of religion during the past two decades. From early questions about content and focus, to later more fundamental paradigm shifts in method and theory, feminist work will be examined, and the impact it has had upon the sub-disciplines of religious studies will be assessed.
Also offered at the undergraduate level, with different requirements, as 34.488B, for which additional credit is precluded.

• Religion 34.531W1
Seminar in Modern Religious Thought and Culture
Topic for 1994-95: Jung's *Answer to Job*
The course will use Jung's late work, *Answer to Job*, to develop the religious and philosophical implications of Jung's understanding of the psyche and its relation to alternative western religiosities manifest in mysticism, alchemy, gnosis and in his thought on quaternity and synchronicity.
Also offered at the undergraduate level, with different requirements, as 34.488B, for which additional credit is precluded.

• Religion 34.532T2, S2
Tutorial in Modern Religious Thought and Culture

• Religion 34.533F1, W1, S1
Directed Studies in Modern Religious Thought and Culture
Seminar for additional study in this area.

• Religion 34.590T2, S2
M.A. Comprehensive Reading
Not open to students pursuing a thesis program.

• Religion 34.599F4, W4, S4
M.A. Thesis

Courses Not Offered in 1994-95

34.510   Seminar in Comparative Religion
34.511   Seminar in Comparative Religion

Department of Spanish

Dunton Tower 1419
Telephone: 788-2109

The Department

Chair of the Department:
P.J. Roster
Departmental Supervisor of Graduate Studies:
Ross Larson

The Department of Spanish offers a master's program, with specialization in either Peninsular or Spanish-American literature, or a combination of both.

All requests for more information concerning the program should be addressed to the departmental supervisor of graduate studies. The Department will supply reading lists for individual courses and for the general comprehensive examination, and a brochure containing details of particular requirements and other information related to Spanish studies at Carleton University.

Master of Arts

Admission Requirements
The requirements for admission to the master's program are outlined in the general section of this calendar.

Program Requirements
The minimum program requirements for master's candidates are stated in the general section.

The master's program may be undertaken in one of the following optional patterns:
- Three full courses (or the equivalent, not including 38.595), and a thesis equivalent to two full courses
- Five full courses (or the equivalent, not including 38.595)

The Department also requires all students to undertake general comprehensive examinations, and to complete a non-credit tutorial on bibliography and research methods.

In certain circumstances, students wishing to study aspects of Hispanic literature not specifically offered by the Department may enrol in Spanish 38.590 or 38.591: Directed Studies, if a specialist in the desired field is available.

All courses taken by graduate students shall be chosen in consultation with the Department. From time to time certain courses offered by other departments may be accepted as part of the master's program in Spanish, and special arrangements may

occasionally be made to undertake part of the program at universities in Spanish-speaking countries.

International Programs for M.A. Graduates from Carleton: Madrid, Buenos Aires

Under the terms of two exchange agreements, students who successfully complete the M.A. in Spanish at Carleton University may register in the Ph.D. program in Spanish literature at the Universidad Autónoma de Madrid or the Ph.D. program in Hispanic literature at the Universidad de Buenos Aires.

Students who have completed a B.A. at Carleton may also register in master's level courses at the Universidad de Buenos Aires.

Details of these programs are available from the Chair of the Department of Spanish and the Director of Carleton International.

Selection of Courses

The following senior undergraduate courses are open to students in the qualifying-year program and, with permission, to students in the M.A. program.

Spanish

38.402	Theories of Literature
38.415	Medieval Spanish Literature from the Origins through 1300
38.416	Medieval Spanish Literature, 1300-1500
38.420	Cervantes
38.430	Modern Spanish Novel
38.431	Contemporary Spanish Novel
38.435	Modern Spanish Drama
38.436	Contemporary Spanish Drama
38.440	Modern Spanish Poetry
38.441	Contemporary Spanish Poetry
38.460	Twentieth-Century Spanish-American Novel I
38.461	Twentieth-Century Spanish-American Novel II
38.470	Twentieth-Century Spanish-American Poetry I
38.471	Twentieth-Century Spanish-American Poetry II
38.490	Seminar on a Special Topic
38.491	Seminar on a Special Topic
38.492	Special Studies

Graduate Courses*

• Spanish 38.506F1
History of the Spanish Language II
Topic for 1994-95: Historical Grammar of the
Spanish Language
Synchronic and diachronic study of the phonetic,
morphological, and syntactic structure of Spanish.
José Jurado.

• Spanish 38.520W1
Aspects of Golden Age Literature
Topic for 1994-95: The Picaresque Novel
An examination of the Spanish Picaresque novel,
with particular reference to *Guzmán de Alfarache*
and *La Picara Justina*, in light of recent interpreta-
tions.
C.A. Marsden.

• Spanish 38.530F1
Problems of Modern Spanish Literature
Topic for 1994-95: Contemporary Spanish Novel
Taught by a visiting professor from Madrid under
the terms of the Madrid-Carleton Agreement.

• Spanish 38.560W1
Aspects of Spanish-American Literature after 1888
Topic for 1994-95: The Spanish-American Short
Story
Intensive and analytical study of the principal
cuentistas of Spanish America.
Ross Larson.

• Spanish 38.570W1
Special Problems in Spanish-American Literature I
Topic for 1994-95: The Concept of Humour in
Twentieth-Century Spanish-American Literature
The study of various theories of humour (irony, the
grotesque, farce, satire and comedy) and analysis of
its stylistic and thematic manifestations in selected
works of poetry, prose and theatre.
P.J. Roster.

• Spanish 38.571F1
Special Problems in Spanish-American Literature II
Topic for 1994-95: The Character of the Immigrant
in Twentieth-Century Argentine and Chilean Theatre
The origin and evolution of the immigrant as a
character in twentieth-century Argentine and
Chilean theatre. Emphasis will be placed on the
dramatic and comic aspects of this figure in plays
that deal with immigration and exile, and on the
socio-historic conditions in which they emerged.
Some of the authors studied will be Armando
Discépolo, Jorge Díaz and Roberto Cossa.
M.A. Giella.

• Spanish 38.590T2, S2
Directed Studies

• Spanish 38.591F1, W1, S1
Directed Studies

• Spanish 38.595F1, W1, S1
Directed Readings
Additional half courses, designed in particular for
students requiring special assistance in preparing
for comprehensive examinations. Students are
required to be enrolled in this course at the time of
taking the examination.

• Spanish 38.599F, W, S
M.A. Thesis

Courses Not Offered in 1994-95

38.505	History of the Spanish Language I
38.515	Aspects of Medieval Literature
38.525	Studies in Eighteenth-Century Literature
38.550	Aspects of Spanish-American Literature before 1888

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etc.
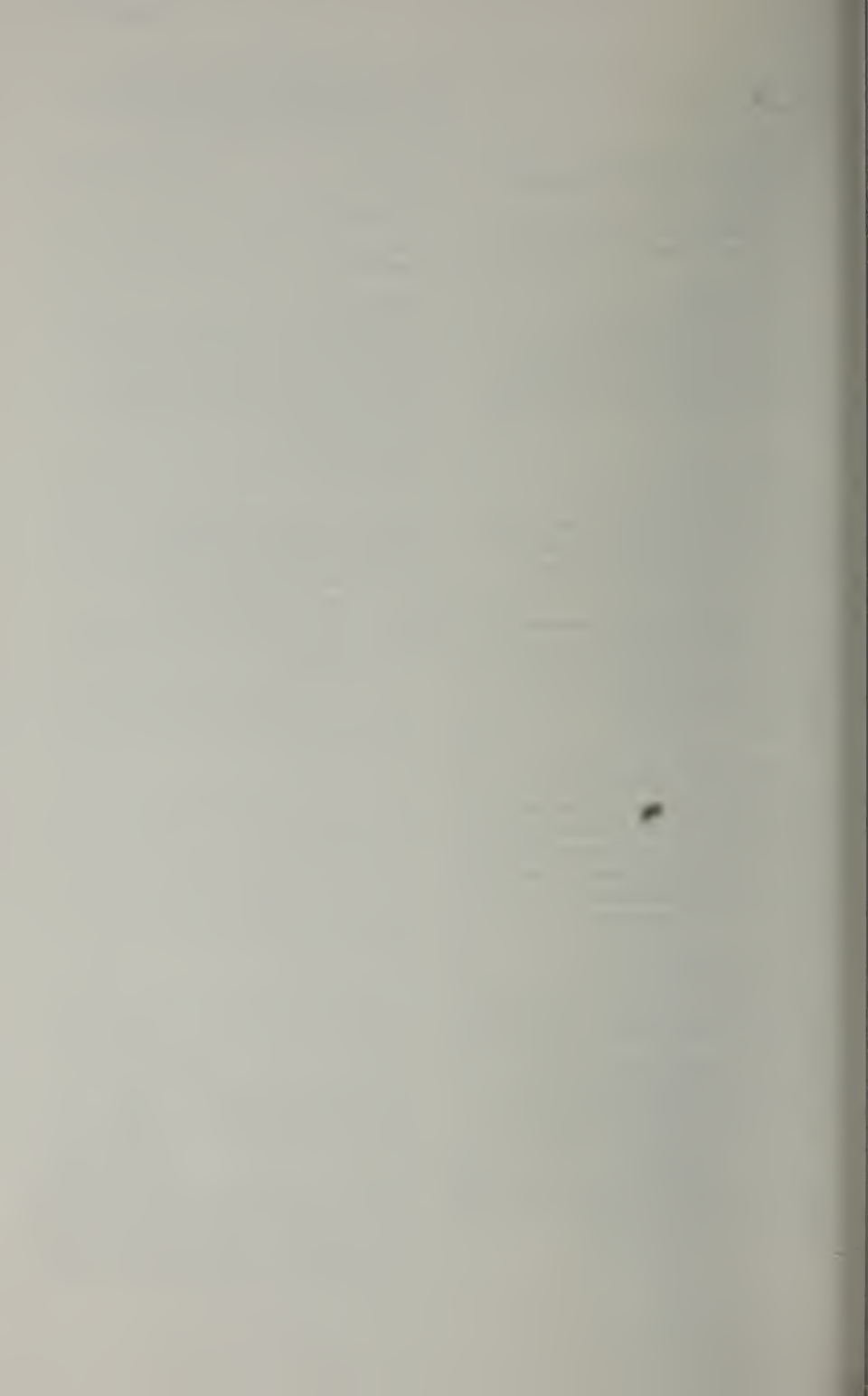
FACULTY OF ENGINEERING

Dean M.J. Bibby

Program Descriptions

and

Details of Courses

Engineering

Programs of study are offered by the Faculty of Engineering leading to the degrees of Master of Engineering and Doctor of Philosophy in Aerospace, Civil, Electrical, and Mechanical Engineering, to the degree of Master of Engineering in Materials Engineering and, in cooperation with the Faculty of Science, to the degree of Master of Science in Information and Systems Science.

The graduate programs in each of the engineering departments at Carleton University and the University of Ottawa are administered through joint institutes in three engineering disciplines. The Ottawa-Carleton Institute for Electrical Engineering was established in 1983; and for Mechanical and Aerospace Engineering, and for Civil Engineering in 1984. Each of these institutes combines the research strengths and resources of departments of engineering at Carleton University and at the University of Ottawa, and provides a framework for interaction. The institutes are also concerned with applications for graduate programs and graduate course offerings. Programs leading to master's and Ph.D. degrees are available through the institutes in a wide range of sub-disciplines in each department.

The areas of current research, the research facilities available, and the graduate courses offered, are given in the following pages for the four departments of the faculty:
- Civil and Environmental Engineering
- Electronics
- Mechanical and Aerospace Engineering
- Systems and Computer Engineering

Both the master's and Ph.D. programs may be undertaken on a full-time or part-time basis.

General information on awards and financial assistance is given in that section of this calendar.

A limited number of students who are not degree candidates may be admitted to each graduate engineering course. Credit earned as a special student normally cannot be credited towards a graduate degree in engineering.

Computing Facilities

Computing facilities available to engineering students include the university's central Honeywell mainframes with time-sharing terminals. In addition two VAX minicomputers, several SGI, SUN and Apollo work-stations and many microcomputers reside in the engineering departments. Several other computers within the faculty are in use for data acquisition and specific research projects.

Special Arrangements

Research in an Outside Institution
A student may apply for permission to carry out his/her research, in part or whole, in an outside institution (for example, industrial, governmental, or university laboratory). Such an application, addressed to the Dean of the Faculty of Graduate Studies and Research through the Dean of Engineering, should:
- Include a detailed statement of the research proposal, of arrangements for supervision, and of the circumstances under which it is to be carried out
- Establish that the applicant will be able to pursue independent research
- State the facilities available for the research
- Include a proposed time schedule
- Be accompanied by a supporting letter from a responsible person in the outside institution giving approval of the proposal and accepting these regulations

Part-time Thesis Research
A part-time research program may be permitted if the conditions for the "presence" of the student (outlined under faculty regulations) are satisfied. It is the responsibility of the research supervisor to define the fraction of full-time research engaged upon by the student so that this can appropriately be credited to his/her program and assessed for payment of tuition fees. Before permission to undertake research on a part-time basis can be granted, the student must submit in writing, to the Dean of the Faculty of Graduate Studies and Research through the Dean of Engineering, a statement of his/her proposed manner of working part time, supported by a letter of approval from his/her employer.

Waiver of Thesis
A candidate for the master's degree who has, before admission, completed independent research or development projects of an adequate level of accomplishment, may apply to the chair of the department concerned for a waiver of the thesis requirement. Such application must be made at the time of initial registration, and must be supported by copies of published reports describing the work. If the application is approved, the candidate must complete ten half-courses or the equivalent, six of which must be graduate-level courses in engineering, to fulfil the requirement for the award of a degree

without a thesis. A candidate who has been granted a waiver of the thesis requirement will be required to take an oral examination on the subject of one of his/her published papers and topics related to his/her field of specialization.

Transfer of Credit

Normally credit for one full graduate course completed at another university may be accepted in partial fulfilment of degree requirements, provided that the course is appropriate to the candidate's program at Carleton University. Under special circumstances a second full course may be allowed. Refer to the general section of this calendar for details of the rules governing transfer of credit.

Transfer from Master's to Ph.D. Program

A student who shows outstanding academic performance and demonstrates high promise for advanced research during the full-time master's program at Carleton University may, subject to meeting the requirements below, and with the approval of the Admissions Committee of the Joint Institute administering his/her graduate program, be permitted to transfer into the Ph.D. program without receiving the master's degree. Such a student must complete the course requirements and thesis registration requirements of the master's program, but is exempted from submission of the thesis.

A student wishing to transfer should apply to the chair of his/her department. If the department and the Faculty of Graduate Studies and Research approve the application, the candidate will be required to take the comprehensive examination for the Ph.D. The requirements for the comprehensive examination will include the submission of a report on research to date, and a research proposal for the Ph.D.

After successfully passing the comprehensive examination, the student will be admitted to the Ph.D. program with normal program requirements (but with the comprehensive examination to his/her credit). If unsuccessful, he/she will remain in the master's program and be required to submit the thesis in the usual way.

Faculty Regulations

Graduate students in the Faculty of Engineering are governed by the section of this calendar entitled General Regulations, and by the regulations stated in this section.

All graduate students in the Faculty of Engineering must obtain satisfactory grades in their course work, must make satisfactory progress in their research if a thesis is included in their program, and must

satisfy the following criteria of activity or "presence" in the program:

- Maintain a close working relationship with their research supervisor
- Attend the courses for which they are registered
- Submit written reports and present seminars as required by their supervisor
- Attend departmental seminars held regularly to discuss current research and related topics. Each student is required from time to time to present a seminar on his/her research; part-time students who are not actively engaged in research are exempt from the seminar requirement
- Be readily available on an informal basis

Thesis Regulations

The thesis must represent the result of the candidate's independent research or development work, undertaken after admission to graduate studies at Carleton University. Experimental or theoretical results previously published by the candidate may be used only as introductory or background material for the thesis. A candidate may be permitted to carry on thesis research work off campus, provided that the work is approved in advance, and arrangements have been made for supervision of thesis research activities by a faculty member of Carleton University. A part-time student may use the Faculty of Engineering laboratory facilities for on-campus thesis research and development activities.

Each candidate submitting a thesis will be required to undertake an oral examination on the subject of the thesis and related fields.

Registration and Course Selection

- Undergraduate engineering courses may not normally be taken for credit
- All students require departmental approval for their program of studies, for course registration, and for any changes to their status or program
- Each full-time student is required, in any fall or winter program requirements of three or more half courses, to register for credit in at least three half courses. After the last day for withdrawal from courses in each such term, the student must remain registered in at least three half courses
- For part-time students, the department will arrange the appropriate course load and selection

Master of Engineering

Admission Requirements

Applicants are admitted under the general regulations specified in this calendar, but, in addition, are required to have strong undergraduate preparation in the appropriate engineering disciplines, computer programing, mathematics, and physics.

Program Requirements

Two alternatives are available for full-time students studying towards the degree of Master of Engineering, one involving a thesis plus course work, the other involving course work only. The choice of these alternatives must be arranged and approved at the time of admission into the program. Students are encouraged to take at least one half course outside of their department.

M.Eng. by Thesis
- A thesis based on the student's research
- A minimum of six half courses in engineering or a related discipline. The number of courses required by each department is specified in its section of this calendar

M.Eng. by Course Work
Specific program requirements are detailed in the departmental sections of this calendar.

Doctor of Philosophy

Admission Requirements

For admission to the Ph.D. program, an applicant must normally hold a master's degree in engineering (or its equivalent) and, by his/her previous program of study and scholastic record, demonstrate a capacity for advanced study and research. Experience gained while working in an engineering or research environment will be taken into account when assessing an application. The applicant must specify his/her intended field of research.

Program Requirements

The specific program requirements for the Ph.D. degree are the following:
- A minimum of two calendar years of full-time study (or the equivalent)
- Course requirements as established on admission, but not less than six half courses, or equivalent, in total (except in the Departments of Systems and Computer Engineering, Electronics, and of Mechanical and Aerospace Engineering); these requirements must include at least four graduate level half courses in engineering. Subject to approval of the student's adviser or advisory committee, the student may take, or be required to take courses in an appropriate discipline outside the Faculty of Engineering. (For information on admission and program requirements for the Departments of Systems and Computer Engineering, Electronics, and of Mechanical and Aerospace Engineering, please refer to pages 136 and 155 respectively)
- Substantial research
- A thesis on the research

Advisory Committee

An advisory committee with at least three members will be appointed by the department soon after a student's first registration. It has the responsibility of ensuring that conditions for the pursuit and completion of the student's program are fulfilled, and it reviews his/her program at least once a year.

Comprehensive Examination

The comprehensive examination is held approximately one year after initial registration in the program in the case of full-time students, and at an equivalent time in the case of part-time students. The purpose of the examination is threefold:
- To assess the student's comprehensive knowledge of his/her field of study
- To assess the preparedness and capability of the student for doctoral research
- To judge the suitability of the research topic for a doctoral thesis

The student is required to present his/her research proposal, and to be subjected to oral and written examination in appropriate fields of study. He/she will be informed by the advisory committee of the specific requirements of the examination. Having successfully completed the comprehensive examination, the student becomes a doctoral candidate.

School of Architecture

Architecture Building 202
Telephone: 788-2855
Fax: 788-2849

The School

Director of the School:
Benjamin Gianni

The School of Architecture does not offer a program at the graduate level. However, it does offer graduate-level courses which can be used towards a degree program in the Faculty of Engineering, the School of Canadian Studies, and the Faculty of Social Sciences at Carleton. There is also an understanding with the Faculty of Environmental Studies at York University, the Centre for Building Studies at Concordia University, and the Faculté de l'Aménagement at the Université de Montréal, that a student registered in their program can apply for permission to do a certain part of the graduate work through course offerings made at the Carleton School of Architecture. Members of the School also supervise graduate research.

The interests and capabilities of the faculty members lie in the following areas:

History and Theory of Architecture
Scholarly studies in architectural thought from renaissance to modern movement, current debate and contemporary issues; Canadian architecture; Mayan architecture; Islamic architecture.

Architecture and Society
Ethnicity, multiculturalism and architectural expression; international development and indigenous architecture; heritage and preservation; evolution of the architecture profession.

Architecture and Technology
Building envelope and construction detail; design economics; structures; energy; lighting; acoustics; integration of systems.

Architecture and the City
Urban morphologies, architectural content of urban planning and design; social, cultural, economic and political matrix in the urban society and the contemporary architectural reality.

Computer-Aided Design and Management
Design and modelling, visual communication, computer graphics; computers and architectural practice.

Architecture and Morphology
Studies in form, space, structure and order; geometric and symbolic orders in architecture.

Graduate Courses*

- Architecture 76.500F1, W1
Directed Studies in History and Theory of Architecture
Reading and research tutorials.

- Architecture 76.501F1, W1
Directed Studies in Architecture and Society
Reading and research tutorials.

- Architecture 77.500F1, W1
Directed Studies in Architecture and Technology
Reading and research tutorials.

- Architecture 77.541F1, W1, S1
Workshop: Technical Studies in Heritage Conservation.
(Also offered as Canadian Studies 12.541)

- Architecture 78.500F1, W1
Directed Studies in Architecture and the City
Reading and research tutorials.

- Architecture 78.542F1, W1, S1
Workshop: Urban Studies in Heritage Conservation
(Also offered as Canadian Studies 12.542)

- Architecture 79.500F1, W1
Directed Studies in Computer-Aided Design
Reading and research tutorials.

- Architecture 79.501F1, W1
Directed Studies in Architecture and Morphology
Reading and research tutorials.
An honours degree or equivalent qualification in a relevant field, as well as permission of the School, is a requirement for admission to these courses.

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* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Ottawa-Carleton Institute for Civil Engineering

Mackenzie Building 277
Telephone: 788-5784
Fax: 788-3951

UNIVERSITÉ D'OTTAWA
UNIVERSITY OF OTTAWA

CARLETON UNIVERSITY

The Institute

Director of the Institute:
Hiroshi Tanaka
Associate Director of the Institute:
K.T. Law

Established in 1984, the Institute combines the research strengths and resources of the Departments of Civil and Environmental Engineering at Carleton University and the Department of Civil Engineering at the University of Ottawa. Programs leading to master's and Ph.D. degrees are available through the Institute in a wide range of fields of civil engineering. Programs in water resources and environmental engineering, and in transportation engineering are centred at the University of Ottawa and Carleton University, respectively. Programs in geotechnical and structural engineering are available at both universities. Graduate students may pursue their research on either university campus, depending upon the choice of program and supervisor. Registration will be at the university to which the student's supervisor is affiliated. Requests for admission may be sent to the Director of the Institute.

Members of the Institute

The "home" department of each member is indicated by (C) for the Department of Civil and Environmental Engineering at Carleton University and (O) for the Department of Civil Engineering at the University of Ottawa.

Kazimierz Adamowski, *Hydrology, Stochastic and Statistical Analyses* (O)

John Adjeleian, *Structures, Building Design and Construction* (C), Professor Emeritus

C.M. Allen,* *Structures, Building Design and Construction* (C)

G.E. Bauer, *Geotechnical Engineering, Earth Retaining Structures, In-Situ Testing* (C)

Volker Barthel,* *Hydraulics* (O)

J.J. Beaudoin,* *Cement Chemistry, Strength of Composite Materials* (O)

* Adjunct Professor, Adjunct Research Professor

J.P. Braaksma, *Transportation, Airport Planning, Traffic Engineering, Pedestrian Circulation, Terminal Design* (C)

M.S. Cheung,* *Finite Element Analysis, Bridge Engineering* (O)

R.L. Droste, *Environmental Engineering, Water and Wastewater Treatment* (O)

Erman Evgin, *Finite Elements, Soil Plasticity, Environmental Geomechanics* (O)

B.H. Fellenius, *Geotechnical Engineering, Deep Foundations* (O)

Leta Fernandez, *Environmental Engineering, Agricultural Waste Management* (O)

N.J. Gardner, *Structures, Reinforced Concrete, Earthquake Engineering, Construction Loads* (O)

V.K. Garga, *Geotechncial Engineering, Dams, Harbours, Heavy Foundations* (O)

A.O. Abd El Halim, *Transportation, Pavements and Materials, Geometric Design* (C)

G.A. Hartley, *Structural Analysis, Finite Elements, Building Frame Analysis* (C)

N.M. Holtz, *Computer-Aided Structural Engineering* (C)

J.L. Humar, *Structures, Earthquake Engineering, Computer-Aided Design* (C)

W.F. Johnson,* *Urban Transportation Planning and Management* (C)

Deniz Karman, *Environmental Engineering, Air Pollution and Control* (C)

S.J. Kennedy, *Steel Structures, Composite Structures, Material Behaviour, Experimental Methods, Computer-Aided Structural Engineering* (C)

K.J. Kennedy,* *Environmental Engineering, Waste Water Treatment* (O)

A.M. Khan, *Transportation, Systems Planning, Engineering and Management* (C)

D.T. Lau, *Structural Mechanics, Earthquake Engineering, Numerical Methods and Modelling of Structures* (C)

K.T. Law, *Geotechnical Engineering, Embankments, In-Situ Testing* (C)

R.R. Mayes,* *Engineering Management* (C)

R.M. Narbaitz, *Waste Treatment* (O)

S.S.F. Ng, *Structures, Numerical Methods, Dynamic Behaviour* (O)

A.G. Razaqpur, *Structures, Concrete, Numerical Methods* (C)

Murat Saatcioglu, *Building Structures, Reinforced Concrete, Earthquake Analysis and Design* (O)

J.J. Salinas, *Building Structures, Wood Engineering, Structural Reliability* (C)

E.J. Schiller, *Environmental Engineering, Water Supply and Irrigation* (O)

A.P.S. Selvadurai,* *Geotechnical Engineering, Continuum Mechanics, Applied Mathematics* (C)
T.S. Sridhar, *Environmental Impact Assessment, Wastewater Treatment, Hazardous and Radioactive Waste, Pollution Control* (C)
G.T. Suter, *Structural Engineering, Masonry Structures* (C)
O.J. Svec,* *Geomechanics, Pavement Materials, Numerical Methods* (C)
Hiroshi Tanaka, *Structures, Wind Engineering* (O)
D.R. Townsend, *Water Resource Engineering, Applied Hydraulics, River Engineering* (O)
E.W. Wright,* *Structures, Computer-Aided Design* (C)

Master's Degree

Admission Requirements

The normal requirement for admission to the master's program is a bachelor's degree with at least high honours standing in civil engineering or the sub-disciplines normally considered to be civil engineering. Applications to a qualifying program will also be considered from graduates of other engineering programs or honours science programs under the following conditions:

(1) Graduates from engineering or honours science programs with a mathematics content equivalent to the civil engineering program will have to take a minimum of four qualifying undergraduate civil engineering courses in their area of graduate specialty;
(2) Graduates from other science programs will have to take all the core engineering undergraduate mathematics courses in addition to the requirements specified in (1) above.

The undergraduate courses required will be specified in the Certificate of Admission.

Undergraduate civil engineering courses will not be accepted towards a graduate degree. Graduate students may still be required to take undergraduate courses for credit to fulfil the admission requirements.

No more than one half of the program credit requirements or that stipulated in the university regulations in which the student is registered, whichever is less, can be transferred at admission. At least one half of the course work must be taken at the Institute.

Program Requirements

The requirements for course work are specified in terms of credits: one hour/week for one term. The requirements for the master's degree by thesis are:
- Equivalent of eighteen course credits
- Thesis
- Participation in the civil engineering seminar series

- Successful oral defence of the thesis

The requirements for the master's degree by course work are: thirty six course credits of which a minimum of twenty four will be course credits and a minimum of six will be project credits.

Doctor of Philosophy

Admission Requirements

The normal requirement for admission into the Ph.D. program is a master's degree with thesis in civil engineering.

Program Requirements

The requirements for course work are specified in terms of credits: one credit = one hour/week for one term.
- A minimum of eighteen course credits
- Participation in the civil engineering seminar series
- Successful completion of written and oral comprehensive examinations in subject areas determined by the student's advisory committee
- Successful completion of a thesis proposal examination
- Thesis
- Successful oral defence of the thesis. The examination board for all theses will include an external examiner, and when possible, professors from both departments
- Subject to approval of his/her advisory committee, a Ph.D. student may take, or be required to take, courses in other disciplines

Students who have been permitted to transfer into the Ph.D. program from a master's program without having completed the master's degree, will require thirty course credits for the Ph.D. degree which include transfer of credits from the incompleted master's program.

Graduate Courses

In all programs, the student may choose graduate courses from either university with the approval of the adviser or the advisory committee. Graduate courses are listed below, grouped by subject area. Course descriptions may be found in the departmental section of the calendar concerned. All courses are of one term duration. The codes given in parenthesis are those used by the University of Ottawa. Courses beginning with "82" are offered at Carleton University and those beginning with "83" are offered at the University of Ottawa. Not all courses listed are necessarily given during one academic year.

Geotechnical and Soils

82.529	(CVG7100)	Case Studies in Geotechnical Engineering
82.530	(CVG7101)	Advanced Soil Mechanics I
82.531	(CVG7102)	Advanced Soil Mechanics II
82.550	(CVG7104)	Earth Retaining Structures
82.551	(CVG7105)	Foundation Engineering
82.552	(CVG7106)	In-situ Methods in Geomechanics
82.553	(CVG7107)	Numerical Methods in Geomechanics
82.554	(CVG7108)	Seepage and Water Flow Through Soils
82.580	(CVG7305) to 82.584 (CVG7309)	Special Topics in Geotechnical Engineering
83.500	(CVG5100)	Deep Foundations
83.501	(CVG5101)	Advanced Rock Mechanics
83.502	(CVG5102)	Theoretical Soil Mechanics
83.503	(CVG5103)	Dam Engineering
83.504	(CVG5104)	Soil Testing and Properties
83.505	(CVG5105)	Slope Stability
83.506	(CVG5106)	Site Improvements
83.509	(CVG5170)	Geotechnical Engineering in Cold Regions
83.512	(CVG5171)	Strength and Deformation Behaviour of Soil and Rock
83.513	(CVG5173)	Soil Dynamics
83.514	(CVG5174)	Soil Plasticity
83.515	(CVG5175)	Mathematical Modelling and Finite Element Applications in Geotechnical Engineering
83.516	(CVG5176)	Soil Structure Interaction
83.517	(CVG5177)	Offshore Geotechnique
83.518	(CVG5178)	Ice Dynamics

Structural Engineering

82.511	(CVG7120)	Introductory Elasticity
82.512	(CVG7121)	Advanced Elasticity
82.513	(CVG7122)	Finite Element Methods in Stress Analysis
82.514	(CVG7123)	Earthquake Engineering and Analysis
82.515	(CVG7124)	Advanced Finite Element Analysis in Structural Mechanics
82.516	(CVG7137)	Dynamics of Structures
82.520	(CVG7138)	Engineered Masonry Behaviour and Design
82.522	(CVG7139)	Behaviour and Design of Steel Structures
82.523	(CVG7125)	Theory of Structural Stability
82.524	(CVG7126)	Behaviour and Design of Structural Steel Members
82.525	(CVG7127)	Behaviour of Elastic Structures
82.526	(CVG7128)	Prestressed Concrete
82.527	(CVG7129)	Advanced Structural Design
82.528	(CVG7130)	Advanced Reinforced Concrete
82.560	(CVG7131)	Project Management
82.561	(CVG7140)	Statistics, Probabilities and Decision-Making Applications in Civil Engineering
82.562	(CVG7141)	Advanced Methods in Computer-Aided Design
82.563	(CVG7132)	Computer-Aided Design of Building Structures
82.564	(CVG7142)	Engineering Management
82.565	(CVG7143)	Design of Steel Bridges
82.566	(CVG7144)	Design of Concrete Bridges
82.575	(CVG7300) to 82.579 (CVG7304)	Special Topics in Structural Engineering
83.521	(CVG5142)	Advanced Structural Dynamics
83.522	(CVG5143)	Advanced Structural Steel Design
83.523	(CVG5145)	Theory of Elasticity
83.524	(CVG5147)	Theory of Plates and Shells
83.526	(CVG5150)	Advanced Concrete Technology
83.527	(CVG5151)	Flow Induced Vibration
83.528	(CVG5152)	Steel Bridges
83.529	(CVG5153)	Wind Engineering
83.530	(CVG5144)	Advanced Reinforced Concrete Design
83.531	(CVG5156)	Finite Element Methods I
83.532	(CVG5146)	Numerical Methods of Structural Analysis
83.533	(CVG5157)	Finite Element Methods II
83.535	(CVG5148)	Prestressed Concrete Design
83.536	(CVG5155)	Earthquake Engineering
83.537	(CVG5158)	Elements of Bridge Engineering

Transportation

82.533	(CVG7160)	Pavements and Materials
82.534	(CVG7150)	Intercity Transportation, Planning and Management
82.535	(CVG7151)	Traffic Engineering
82.536	(CVG7152)	Highway Materials
82.537	(CVG7153)	Urban Transportation, Planning and Management
82.538	(CVT7154)	Geometric Design
82.539	(CVG7155)	Transportation Supply
82.541	(CVG7156)	Transportation Economics and Policy

82.542	(CVG7159)	Transportation Terminals
82.543	(CVG7158)	Airport Planning
82.585	(CVG7310) to 82.589 (CVG7314)	
	Special Topics in Transportation Planning and Technology	

Water Resources

83.550	(CVG5110)	Hydraulics of Open Channels
83.551	(CVG5111)	Hydraulic Structures
83.552	(CVG5114)	Hydraulics and Porous Media
83.553	(CVG5115)	Advanced Fluid Mechanics
83.556	(CVG5120)	Water Resources Systems
83.558	(CVG5122)	Groundwater and Seepage
83.559	(CVG5123)	Advanced Topics in Hydrology
83.561	(CVG5125)	Statistical Methods in Hydrology
83.562	(CVG5126)	Stochastic Hydrology
83.563	(CVG5127)	Hydrologic Systems Analysis
83.564	(CVG5128)	Water Resources Planning and Policy
83.566	(CVG5131)	River Engineering
83.567	(CVG5140)	Irrigation and Drainage
83.568	(CVG5135)	Water Supply and Sanitation in Developing Countries
83.582	(CVG5118)	Theory and Operation of Hydraulic Models
83.583	(CVG5119)	Computational Hydraulics

Environmental

83.590	(CVG5130)	Wastewater Treatment Process Design
83.591	(CVG5132)	Unit Operations of Water Treatment
83.593	(CVG5139)	Environmental Assessment of Civil Engineering Projects
83.594	(CVG5136)	Water and Wastewater Treatment Laboratories
83.595	(CVG5137)	Water and Wastewater Treatment Process
83.596	(CVG5133)	Solid Waste Disposal
83.597	(CVG5134)	Chemical Analysis for Environmental Engineering

Directed Studies

82.596 and 82.597   Engineering Directed Studies

83.570 (CVG6108) and 83.571 (CVG6109)
    Individual Directed Studies

83.600-83.603 (CVG6300-6399)
    Advanced Topics

Projects and Theses

82.590	Engineering Project
82.599	M.Eng. Thesis
82.699	Ph.D. Thesis
CVG6000	Civil Engineering Report/ Rapport en génie civil
CVG7999	M.A.Sc.Thesis/Thèse
CVG9998	Comprehensive Examination (Ph.D.) Examen general de doctorat
CVG9999	Ph.D. Thesis/Thèse

Department of Civil and Environmental Engineering

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The Department

Chair of the Department:
A.G. Razaqpur
Departmental Supervisor of Graduate Studies:
K.T. Law

The Department of Civil and Environmental
Engineering offers programs of study and
research leading to the Master of Engineering and
Ph.D. degrees in Civil and Environmental
Engineering. These degrees are offered through
the Ottawa-Carleton Institute for Civil Engineering
which is jointly administered by the Department
of Civil and Environmental Engineering at
Carleton University, and the Department of Civil
Engineering at the University of Ottawa. For further
information, including admission and program
requirements, see page 115.

The Department conducts research and has
developed graduate programs in the following
areas:

• Geotechnical Engineering
The graduate program in geotechnical engineering
places an emphasis on both theoretical and applied
problems related to soil and rock mechanics and
foundation engineering. These generally include
the study of mechanical properties of soil and rock
materials, stability of natural slopes and earth
embankments, soil-foundation-structure interac-
tion, and problems in foundation design and
geomechanics. Broader programs in geotechnical
engineering may be arranged by making use of
courses offered in the Department of Geography
at Carleton University and in the Department
of Civil Engineering at the University of Ottawa.

Graduate research in geotechnical engineering
is primarily directed towards the following areas:

Soil-Foundation Interaction
Elastic and consolidation effects of soil-foundation
interaction; soil-frame interaction; contact stress
measurement; performance of rigid and flexible
foundations; buried pipelines.

Earth Retaining Structures
Experimental and analytical studies of anchored
and braced excavations, flexible and rigid retaining
walls, soil reinforcement, tunnels and conduits,
field behaviour.

Bearing Capacity and Settlement
Problems related to design of bridge abutments
and footings located on sloped granular fill,
experimental and field studies.

In-Situ Testing of Soils
The use of devices such as the pressuremeter,
the screw plate test, the borehole shear device,
and borehole dilatometer in the assessment of
geotechnical properties of soils.

Mechanical Behaviour
Development of constitutive relations for soils and
rock masses with yield and creep characteristics;
applications to foundation engineering.

Mechanics of Geological Structures
Large strain phenomena; buckling of strata; applica-
tions to underground storage structures; hydraulic
fracture of oil- and gas-bearing geological media.

Performance of Anchors
Theoretical and experimental analysis of deep and
shallow anchors in soil, rock and concrete; group action;
creep effects; prestress loss.

Nuclear Waste Disposal
Theoretical modelling of rockmass-buffer-canister
interaction during moisture migration; non-
homogeneous swelling of buffer materials; swelling
pressures in buffer systems; coupled heat and
moisture flow in materials.

• Structural Engineering
The graduate program in structural engineering
embodies a broad spectrum of topics involving
material behaviour, structural mechanics and
analysis, and the behaviour and design of buildings
and bridges. These topics are in the following
fields: computer applications in structural analysis;
structural dynamics, seismic analysis, earthquake
engineering; finite element analysis; structural
systems and design optimization; behaviour and
design of steel, concrete, composite, timber and
masonry structures; integrated treatment of
structural, mechanical and electrical building
requirements; construction economics; project
planning; and bridge engineering. Graduate
research in structural engineering is primarily
directed towards the following areas:

Computer Applications in Structural Design
Development of knowledge-based systems for the analysis, design, detailing, fabrication and erection of buildings and bridges. Includes graphic interfaces, pre- and post-processing of frame analysis, load determination and finite element analysis packages.

Seismic Analysis and Design
Seismic response of set-back and other irregular buildings; computer analyses of linear and non-linear structural response; design of buildings for seismic forces; seismic behaviour of liquid storage tanks; fluid structure interaction problems.

Continuum Mechanics
Linear and non-linear problems in elasticity; analysis of contact problems in elasticity, plasticity, and viscoelasticity; mechanics of composite materials; fracture processes in geological materials; finite deformations of rubber-like materials; poro-elasticity and micromechanics.

Numerical Modelling of Buildings and Bridges
Advanced analytical modelling of reinforced and prestressed concrete, steel, and composite concrete-steel buildings and bridges. Material and geometric non-linearities, bond-slip, the advent and propagation of cracks, tension-stiffening and shear-connectors behaviour are modelled to predict the full response of structures up to failure.

Behaviour and Design of Steel, Concrete and Composite Structures
Analytical and experimental studies of structural members, substructures and connections for buildings, bridges and offshore structures. Development of the corresponding limit states design format design rules.

Masonry Behaviour and Design
Study of strength and serviceability issues by means of theoretical approaches, testing and field work.

Timber Structures
Analysis, design and performance evaluation of wood-structured systems and components; structural reliability.

• Transportation Planning and Technology
The graduate program in transportation planning and technology deals with problems of policy, planning, economics, design, and operations in all modes of transportation. In the area of transportation planning, the focus is on the design of transport systems, including terminals, modelling and simulation, urban and regional studies, traffic engineering, and geometric design. In the transportation technology area, programs deal with technology of vehicles and facilities, acoustics and noise,

materials and pavement design. Graduate research in transportation is currently focused on the following areas:

Transport Policy
Assessment and impact analysis of national, regional, and urban transportation policies.

Planning and Design Methodology
Development and application of models for optimization of transport supply, transportation system management.

Travel and Traffic Analysis
Behavioural theories of passenger travel, goods movement, empirical traffic studies.

Transportation Terminals
Airport planning, air terminal design; bus, rail, subway terminal design, layout methods, pedestrian traffic.

Transportation Technology Development and Assessment
Modernization of passenger and freight rail services; soil properties; pavement design, multi-layered systems, low temperature cracking of pavements, thermo-mechanical modelling of fracture processes in pavements, highway design, energy.

Departmental Facilities
The structures laboratory facility includes an 11 m x 27 m strong floor with a clear height of 11 m; a strong pit, measuring 3 m x 3.7 m x 6.6 m for geotechnical and highway material testing; a 400,000 lb. universal testing machine with auxiliary equipment for load and displacement control; numerous hydraulic actuators; test frames; specialized equipment for torsion and impact studies; and a wide selection of measurement devices (strain gauges, LVDTs, pressure transducers, load cells, thermocouples) and several data acquisition systems for testing structural materials and components. The concrete laboratory has facilities for the casting, curing, and testing of reinforced concrete members. Laboratory facilities in geotechnical engineering include both large scale and conventional tri-axial testing, consolidation testing, pore water pressure measurements, and model studies of contact stress measurements. The soil dynamics and highway materials laboratories provide facilities for studies of the physical properties of soil, stabilized soil, aggregate and bituminous mixtures.

Computer-related equipment with the department comprises an HP9000, several Apollo and SUN workstations, a network of microcomputers and related peripherals. The computing centre of the University provides access to a Honeywell Level 66 computer and SUN4 workstation. A library of computer

programs in structural, geotechnical and transportation engineering provides a significant resource for advanced study and research.

Graduate Courses

All courses listed are *one-term courses* and may be offered in either fall or winter with the exception of projects and theses. Please consult the current course listing at the beginning of the fall and winter terms.

* Engineering 82.511 (CVG7120)
Introductory Elasticity
Stresses and strains in a continuum; transformations, invariants; equations of motion; constitutive relations, generalized Hooke's Law, bounds for elastic constants: strain energy, superposition, uniqueness; formulation of plane stress and plane strain problems in rectangular Cartesian and curvilinear coordinates, Airy-Mitchell stress functions and Fourier solutions, application of classical solutions to problems of engineering interest.

* Engineering 82.512 (CVG7121)
Advanced Elasticity
Continuation of topics introduced in Engineering 82.511. Complex variable solutions: torsional and thermal stresses; axially symmetric three-dimensional problems, Love's strain potential, Boussinesq-Galerkin stress functions; problems related to infinite and semi-infinite domains. Introduction to numerical methods of stress analysis, comparison of solutions.
Prerequisite: Engineering 82.511 or permission of the Department.

* Engineering 82.513 (CVG7122)
Finite Element Methods in Stress Analysis
Stress-strain and strain-displacement relationships from elasticity. Plane stress and plane strain finite elements. Lagrange interpolation and Lagrange based element families. Introduction to the theory of thin plates; overview at plate bending elements. General formulation of the finite element method.

* Engineering 82.514 (CVG7123)
Earthquake Engineering and Analysis
Advanced topics in earthquake engineering: description of earthquake motions, seismological background; analysis of earthquake response, response spectrum approach, multiple input excitation, extended Ritz coordinates, complex eigenproblem analysis; response analysis via frequency domain; design considerations and code requirements, earthquake forces in building codes; dynamic soil-structure interaction, direct method, substructure method, fundamentals of wave

propagation, half-space modelling of soil; dynamic fluid-structure interaction, incompressible and compressible fluid elements, substructure method with liquid continuum; special topics of current interests.
Prerequisite: Engineering 82.516 or permission of the Department.

* Engineering 82.515 (CVG7124)
Advanced Finite Element Analysis in Structural Mechanics
Fundamentals of calculus of variations; variational and Galerkin formulations: assumed displacement, assumed stress and hybrid elements; isoparametric elements and numerical integration; plate bending: convergence, completeness and conformity, patch test, Kirchhoff and Mindlin plate theories, nonlinear elasticity and plasticity; cracking and non-linearities in reinforced concrete structures; incremental and iterative schemes, geometric non-linearity: small strain–large displacement, large strain–large displacement, Eulerian and Lagrangian formulations; finite elements in dynamics; finite element programing.
Prerequisite: Engineering 82.513 or permission of the Department.

* Engineering 82.516 (CVG7137)
Dynamics of Structures
Structural dynamics, single and multi-degree-of-freedom systems, formulation of equations of motion, methods of analytical mechanics, free and forced vibrations, normal mode analysis, numerical methods for the response analyses of single and multiple-degree-of-freedom systems.

* Engineering 82.520 (CVG7138)
Engineered Masonry Behaviour and Design
Properties of masonry materials and assemblages. Behaviour and design of walls, columns and lintels. Treatment of specialized design and construction topics. Design of lowrise and highrise structures. Discussion of masonry problems. Emphasis throughout the course is placed on a practice-oriented approach.

* Engineering 82.522 (CVG7139)
Behaviour and Design of Steel Structures
Brittle fracture and fatigue; behaviour of plate girders; composite beams, girders and columns; stub girders; plastic design principles; frame behaviour; structural stability; bracing of members and frames.
Prerequisite: Engineering 82.524 or permission of the Department.

* Engineering 82.523 (CVG7125)
Theory of Structural Stability
Elastic and inelastic behaviour of beam-columns; elastic and inelastic buckling of frames; application

of energy methods to buckling problems; lateral-torsional buckling of columns and beams; buckling of plates; local buckling of columns and beams. *Prerequisite:* Engineering 82.525 or equivalent.

• Engineering 82.524 (CVG7126)
Behaviour and Design of Structural Steel Members
Limit states design philosophy; material behaviour; tension members; plate buckling; torsion; lateral torsional buckling; beams, axially loaded columns and beam-column behaviour; bolted and welded connections; applications in design.

• Engineering 82.525 (CVG7127)
Analysis of Elastic Structures
Application of matrices to structural analysis; force and displacement method of analysis for framed elastic planar and space structures; symmetric and anti-symmetric structures.

• Engineering 82.526 (CVG7128)
Prestressed Concrete
Prestressed concrete materials; working stress design for flexure; ultimate strength design for flexure, shear, and torsion; prestress losses; deflection and camber; slabs; indeterminate beams and frames; introduction to prestressed bridges and circular tanks.

• Engineering 82.527 (CVG7129)
Advanced Structural Design
A number of topics, such as the evolution of a structure, structural form, aesthetics, progressive collapse, and design in various structural materials, are treated by members of the Department and outside experts.

• Engineering 82.528 (CVG7130)
Advanced Reinforced Concrete
The research background, development, and limitations in current building code provisions for reinforced concrete; yield line theory of slabs; safety and limit state design; computer design of concrete structures.

• Engineering 82.529 (CVG7100)
Case Studies in Geotechnical Engineering
The critical study of case histories relating to current procedures of design and construction in geotechnical engineering. The importance of instrumentation and monitoring field behaviour will be stressed. In-situ testing.

• Engineering 82.530 (CVG7101)
Advanced Soil Mechanics I
Effective stress, pore pressure parameters, saturated and partially saturated soils; seepage; permeability tensor, solutions of the Laplace equation; elastic equilibrium; anisotropy, non-homogeneity, consolidation theories; shear strength of cohesive and cohesionless soils.

• Engineering 82.531 (CVG7102)
Advanced Soil Mechanics II
Plasticity in soil mechanics; failure and yield criteria, plastic equilibrium, upper and lower bound solutions, uniqueness theorems; statically and kinematically admissible states; stability analysis of cohesive and cohesionless soils.

• Engineering 82.533 (CVG7160)
Pavements and Materials
An analysis of the interaction of materials, traffic, and climate in the planning, design construction, evaluation, maintenance, and rehabilitation of highway and airport pavements.

• Engineering 82.534 (CVG7150)
Intercity Transportation, Planning and Management
Current modal and intermodal issues, including energy. Framework and process of intercity transport planning and management. Recent trends and system development. Passenger and freight demand and service characteristics. Future prospects and possibilities.

• Engineering 82.535 (CVG7151)
Traffic Engineering
Introduction to principles of traffic engineering. Basic characteristics of drivers, vehicles, and traffic. Volume, speed, and delay studies. Traffic stream characteristics and queuing theory. Capacity analysis of roads and intersections. Safety.

• Engineering 82.536 (CVG7152)
Highway Materials
Materials characterization and strength evaluation of soils, stabilized soils, aggregates, and asphalt concrete. Effects of low temperatures and frost on materials behaviour.

• Engineering 82.537 (CVG7153)
Urban Transportation Planning and Management
Urban transportation systems planning and management. Urban development models — an introduction. Urban transportation policy.

• Engineering 82.538 (CVG7154)
Geometric Design
Basic highway geometric design concepts. Vertical and horizontal alignment. Cross-sections. Interchange forms and design. Adaptability and spacing of interchanges. Design of operational flexibility; operational uniformity, and route continuity on freeways.

• Engineering 82.539 (CVG7155)
Transportation Supply
Advanced treatment of transportation planning and management concepts and techniques: transport

supply issues, capacity and costs, evaluation of system improvements and extensions, transportation and development, policy impact analysis.

• Engineering 82.541 (CVG7156)
Transportation Economics and Policy
Transportation, economic analysis framework. Transport industry output. Carrier operations. Issue of resource utilization, measurement, economics, supply of infrastructure, pricing; subsidies, externalities. Transport policy in Canada.

• Engineering 82.542 (CVG7159)
Transportation Terminals
Framework for passenger terminal planning and design. Theory: the transfer function and network modelling; pedestrian flow characteristics; capacity of corridors, stairs, escalators, and elevators; layout planning. Practical applications: air, rail, metro, bus, ferry, and multi-modal terminals.

• Engineering 82.543 (CVG7158)
Airport Planning
Framework for airport planning and design. Aircraft characteristics; demand forecasting; airport site selection; noise; airside capacity; geometric design; the passenger terminal complex; cargo area; general aviation; ground transportation; land use planning.

• Engineering 82.550 (CVG7104)
Earth Retaining Structures
Approaches to the theoretical and semi-empirical analysis of earth retaining structures. Review of the earth pressure theories. Analysis and design methods for rigid and flexible retaining walls, braced excavations, and tunnels. Instrumentation and performance studies.

• Engineering 82.551 (CVG7105)
Foundation Engineering
Review of methods of estimating compression and shear strength of soils. Bearing capacity of shallow and deep foundations. Foundations in slopes. Pile groups. Use of in-situ testing for design purposes.

• Engineering 82.552 (CVG7106)
In-Situ Methods in Geomechanics
Scope of a subsurface exploration program. Techniques of soil and rock sampling. Geo-physical methods. Mechanical and hydraulic properties of soil and rock. In-situ determination of strength, deformability and permeability of soils and rocks. Critical evaluation of vane, pressuremeter, screw plate, flat dilatometer, borehole shear and plate load tests. Pumping, recharge and packer tests. Permeability of jointed rocks. Rock testing techniques, borehole dilatometer, flat jack, cable jacking tests. Properties of rock joints. In-situ stress measurements.

• Engineering 82.553 (CVG7107)
Numerical Methods in Geomechanics
Critical review of advanced theories of soil and rock behaviour. Linear elasticity, non-homogeneity and anisotropy. Plasticity models. Generalized Mohr-Coulomb and Rucker-Prager failure criteria. Critical state and cap models. Dilatancy effects. Associative and non-associative flow rules. Hardening rules, hypo-elasticity. Soil consolidation, visco-elasticity and creep behaviour of rock masses. Rock joints. Finite element formulation of nonlinear problems. Iterative schemes; tangent stiffness, initial stress and initial strain techniques, mixed methods. Time marching schemes. Solution of typical boundary value problems in geomechanics with the aid of existing research class finite element codes.
Prerequisite: Engineering 82.511, 82.513, or permission of the Department.

• Engineering 82.554 (CVG7108)
Seepage and Waterflow through Soils
Surface-subsurface water relations. Steady flow. Flownet techniques. Numerical techniques. Seepage analogy models. Anisotropic and layered soils. Water retaining structures. Safety against erosion and piping. Filter design. Steady and non-steady flow towards wells. Multiple well systems. Subsidence due to ground water pumping.

• Engineering 82.560 (CVG7131)
Project Management
Introduction to managing the development, design, and construction of buildings. Examination of project management for the total development process, including interrelationships among owners, developers, financing sources, designers, contractors, and users; role and tasks of the project manager; setting of project objectives; feasibility analyses; budgets and financing; government regulations; environmental and social constraints, control of cost, time, and content quality and process; human factors.

• Engineering 82.561 (CVG7140)
Statistics, Probabilities and Decision-Making Applications in Civil Engineering
Review of basic concepts in statistics and the Theory of Probabilities. Bayes' Theorem. Probability distributions. Moments. Parameter Estimation. Goodness-of-fit. Regression and correlation. OC curves. Monte Carlo simulation. Probability-based design criteria. Systems reliability. Limit States Design. Selected applications in transportation, geomechanics and structures. Emphasis will be given to problem solving. Use of existing computer software.

• Engineering 82.562 (CVG7141)
Advanced Methods in Computer-Aided Design
Representation and processing of design constraints
(such as building codes and other design rules);
decision tables; constraint satisfaction. Automatic
integrity and consistency maintenance of design
databases; integrated CAD systems. Introduction to
geometric modelling. Introduction to artificial
intelligence.

• Engineering 82.563 (CVG7132)
Computer-Aided Design of Building Structures
Relevant aspects of computer systems, information
handling, auxiliary storage; design methods,
computerized design systems, computer graphics;
application of structural theory; examination of a
selected series of structural engineering programs
and programming systems.

• Engineering 82.564 (CVG7142)
Engineering Management
Engineering management principles, including program
and project organization, personnel management,
major management systems, project management,
legal aspects of management, communication problems,
politics and management, management of the
engineering competition and union-management
problems.

• Engineering 82.565 (CVG7143)
Design of Steel Bridges
Basic features of steel bridges, design of slab-on-girder,
box girder and truss bridges. Composite and non-
composite design. Introduction to long span suspension
and cable-stayed bridges. Discussion of relevant
codes and specifications.

• Engineering 82.566 (CVG7144)
Design of Concrete Bridges
Concrete and reinforcing steel properties, basic fea-
tures of concrete bridges, design of superstructure
in reinforced concrete slab, slab-on-girder and box
girder bridges, an introduction to prestressed
concrete bridges, design of bridge piers and
abutments. In all cases the relevant provisions of
Canadian bridge codes are discussed.

• Engineering 82.575-82.579 (CVG7300-7304)
Special Topics in Structural Engineering
Courses in special topics related to building design
and construction, not covered by other graduate
courses; details will be available some months prior
to registration.

• Engineering 82.580-82.584 (CVG7305-7309)
Special Topics in Geotechnical Engineering
Courses in special topics in geotechnical engineering,
not covered by other graduate courses; details will
be available some months prior to registration.

• Engineering 82.580 (CVG7305)
Analysis of Embankments and Slopes
Stability of embankments of soft clays; stress-strain
analysis; anisotropy; strain rate effect; short and
long-term settlement; methods of slope stability
analysis; progressive failure; use of stability charts;
slope analysis for residual and unsaturated soils.

• Engineering 82.585-82.589 (CVG7310-7314)
Special Topics in Transportation Planning and
Technology
Courses in special topics in transportation engi-
neering, not covered by other graduate courses;
details will be available some months prior to
registration.

• Engineering 82.590
Civil Engineering Project
Students enrolled in the M.Eng. program by course
work will conduct an engineering study, analysis,
or design project under the general supervision of a
member of the Department.

• Engineering 82.596 and 82.597
Directed Studies

• Engineering 82.599
M.Eng. Thesis

• Engineering 82.699
Ph.D. Thesis

Other Courses of Particular Interest

Mechanical and Aerospace Engineering

88.514	Ground Transportation Systems and Vehicles
88.517	Experimental Stress Analysis
88.521	Methods of Energy Conversion
88.550	Advanced Vibration Analysis
88.561	Creative Problem Solving and Design
88.562	Failure Prevention
88.568	Advanced Engineering Materials

Systems and Computer Engineering

94.501	Simulation and Modelling

Geography

45.415E	Slope Development: Forms, Processes and Stability
45.417	Glacial Geomorphology

45.532	Soil Thermal and Hydrologic Properties
45.533	Periglacial Geomorphology
45.534	Aspects of Clay Mineralogy and Soil Chemistry
45.579	Research and Development in Outdoor Recreational Geography

Public Administration

| 50.510 | Management Accounting |
| 50.511 | Financial Management |

Ottawa-Carleton Institute for Electrical Engineering

3010 Minto CASE
1125 Colonel By Drive
Telephone: 788-5659
Fax: 788-5682

UNIVERSITÉ D'OTTAWA
UNIVERSITY OF OTTAWA

CARLETON UNIVERSITY

The Institute

Director of the Institute:
G.M. Karam

Established in 1983, the Institute combines the research strengths and resources of the Departments of Electronics and of Systems and Computer Engineering at Carleton University and the Department of Electrical Engineering at the University of Ottawa. Programs leading to master's and Ph.D. degrees are available through the Institute in a wide range of fields of electrical engineering. Graduate students may pursue their research on either university campus, depending upon the choice of supervisor. Registration will be at the university most appropriate to the student's program of studies and research.

Requests for information and applications for admission should be sent to the Director of the Institute.

Members of the Institute

The home department of each member is indicated by (OE) for the Department of Electrical Engineering, University of Ottawa; (CE) for the Department of Electronics, Carleton University; (SCE) for the Department of Systems and Computer Engineering, Carleton University.

T.A. Aboulnasr, *Digital Signal Processing, Applications in Communications* (OE)

N.U. Ahmed, *Systems Theory, Optimal Control, Filtering and Identification with Applications to Spacecraft, Optical Networks and Artifical Hearts* (OE)

S.A.H. Aly,* *Signal Processing, Digital Transmission* (SCE)

Prakash Bhartia,* *Microwaves, Antennas, Instrumentation* (OE)

A.R. Boothroyd,* *Solid State Devices, ICs, CAD* (CE)

R.J.A. Buhr, *Software Design, Real-Time and Distributed Systems, Object-Oriented Design* (SCE)

G.D. Boudreau,* *Digital Communications, Efficient Coding, Spread Spectrum Communication* (OE)

R.J.C. Bultitude,* *Digital Radio, Propagation, Mobile and Portable Radio Systems* (SCE),

C.H. Chan, *VLSI Circuits, Systems* (CE)

J.W. Chinneck, *Computer Modelling, Operations Research, Applied Optimization* (SCE)

J.-Y. Chouinard, *Mobile Communications, Wireless and Mobile Communications, Modulation and Coding, Cryptography* (OE)

Jacek Chrostowski,* *Photonics, Sensors* (OE)

D.C. Coll, *Telecommunications and Computers, Image Processing* (SCE)

M.A. Copeland, *ICs, Analog Signal Processing, CAD, Digital Radio* (CE)

G.I. Costache, *Electromagnetic Interference and Compatibility* (OE)

S.R. Das, *Digital Circuits, Fault-Tolerant Computing* (OE)

N.W. Dawes,* *Artificial Intelligence, Pattern Recognition, Diagnosis* (SCE)

M.S. El-Tanany, *Mobile and Portable Communications, Digital Signal Processing, Synchronization* (SCE)

D.D. Falconer, *Digital Communications, Signal Processing, Mobile and Portable Digital Communications* (SCE)

P.A. Galko, *Digital Communications, Optical Communications* (OE)

N.D. Georganas, *Multimedia Communications, Computer Communications* (OE)

D.T. Gibbons, *Digital and Biomedical Electronics, Computer Engineering* (OE)

K.R. Goheen, *Controls, CAD/CAM/CIM* (SCE)

M.C. Goldberg,* *Image Processing, Image Communications* (OE)

R.A. Goubran, *Audio Signal Processing, Digital Systems Design, Adaptive Systems* (SCE)

T.A. Gulliver, *Communications, Spread Spectrum, Digital Algebraic Coding Theory* (SCE)

H.M. Hafez, *Wireless Communications, Neural Networks* (SCE)

R.G. Harrison, *Microwaves, Non-linear Processes* (CE)

W.J.R. Hoefer,* *CAD/CAM of Microwave and Millimeter-Wave Circuits, Numerical Methods, Electromagnetic Modelling* (OE)

Dan Ionescu, *Computers, Artificial Intelligence, Image Processing, Discrete Event and Real-Time Systems* (OE)

G.M. Karam, *Software Engineering, Concurrent Systems, Logic Programing* (SCE)

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* Adjunct Professor, Adjunct Research Professor

Ahmed Karmouch, *Multimedia Communications, Multimedia Real-Time Distributed Information Systems and Databases* (OE)

Satish Kashiap,* *Electromagnetic Compatibility, Electromagnetic Pulse, High Power Microwaves, Electromagnetic Analysis* (OE)

Mohsen Kavehrad, *Digital Communications, Optical Communications and Networking, Mobile and Portable Communications* (OE)

A.R. Kaye, *Broadband ISDN, Computer Networks, High-Speed Networks, Network Management* (SCE)

J.P. Knight, *Logic Design, Computer-Aided IC Design, VLSI Testing* (CE)

Moshe Krieger, *Real-Time System Design, Micro-processor-Based Systems, Software Engineering, Computer Architecture* (OE)

T.A. Kwasniewski, *Digital and Analog Signal Processing, Microprocessors* (CE)

Ioannis Lambadaris, *Computer Networks* (SCE)

M.C. Lefebvre, *Computer-Aided I.C. Design, VLSI Design* (CE)

J.H. Lodge,* *Mobile Communications, Modulation, Channel Coding, Multiple Access* (OE)

S.A. Mahmoud, *Mobile and Portable Communication Systems, Communication Network Protocol* (SCE)

Shikaresh Majumdar, *Parallel and Distributed Systems, Operating Systems, Performance Evaluation* (SCE)

L.S. Marshall,* *Software Engineering, Software Validation and Formal Specification Tools* (SCE)

W.F. McGee,* *Communications, Circuits, Digital Signal Processing* (OE)

J.W. Miernik,* *Telecommunications Traffic Engineering, Simulation and Modelling of Traffic* (SCE)

L.R. Morris, *DSP, Microcomputers, Speech and Image Processing, Computer Architecture*(SCE)

H.T. Mouftah,* *Computer Communications* (OE)

M.S. Nakhla, *Computer-Aided Engineering, Simulation and Optimization* (CE)

M.M. Ney, *Electromagnetic Engineering, Microwaves, Numerical Modelling* (OE)

R.J-F. Normandin,* *Photonics* (CE)

Abdellatif Obaid,* *Specification, Design and Verfication of Communication Protocols* (SCE)

M.D. O'Riain,* *Biomedical Engineering* (OE)

L. Orozco-Barbosa,* *Computer Architecture, Communication Networks and Performance Evaluation* (OE)

Bernard Pagurek, *Network Fault Management, Artifical Intelligence, Diagnosis* (SCE)

Sethuraman Panchanathan, *Computer Engineering, Video Compression, Image Processing, Parallel Processing* (OE)

Panayota Papantoni-Kozakas, *Communication Theory, Computer Communication Networks, Neural Networks, Statistical Interference* (OE)

R.D. Peacock,* *Artifical Intelligence* (SCE)

D.C. Petriu, *Performance Evaluation, Software Engineering, Database Systems* (SCE)

E.M. Petriu, *Robotics, Sensing and Perception, Neural Networks* (OE)

Calvin Plett, *Analog I.C. Design* (CE)

J.S. Riordon, *Mobile Communication Systems, Distributed Databases* (SCE)

J.A. Rolia, *Software Performance, Queuing Networks, Petri-Nets, Performability* (SCE)

H.M. Schwartz, *Robotics, Controls* (SCE)

A.U.H. Sheikh, *Universal Telecommunications Systems, Data Communication, Digital Signal Processing* (SCE)

T.J. Smy, *Semiconductor Devices and Transducers, IC Technology* (CE)

W.M. Snelgrove, *Analog Signal Processing, VLSI* (CE)

W.J.D. Steenaart,* *Digital Communications, Digital Signal Processing, Array Realization and Application* (OE)

P.C. Strickland,* *Antennas, Microwaves* (CE)

S.S. Stuchly,* *Microwaves, Antennas, Instrumentation* (OE)

B.A. Syrett, *Microwave Integrated Circuits, Optical Interconnects* (CE)

N.G. Tarr, *Solid State Devices, IC Fabrication* (CE)

R.E. Thomas,* *Solid State Technology, Solar Energy* (CE)

P.D. van der Puije, *Circuit Synthesis, Biomedical Engineering* (CE)

D.J. Walkey, *Simulation and Modelling of Sub-micron MOS and Bipolar VLSI Devices* (CE)

J.S. Wight, *Radar, Spread Spectrum and Navigation Systems, Microwave Circuits, Antennas, Synchronizers, Phase-Locked Circuits* (CE)

C.M. Woodside, *Computer Performance, Queuing, Distributed System Design* (SCE)

O.W. Yang, *Computer Communications, Broadband Networks, Performance Evaluation, Network Interconnection, Queuing Theory* (OE)

Tet Yeap, *Neural Networks, Parallel Computer Architectures, VLSI, Digital Systems and Control* (OE)

Abbas Yongaçoglu, *Digital Communications Coding and Modulation, Spread Spectrum Systems* (OE)

Q.J. Zhang, *CAD for VLSI, Optimization* (CE)

Master's Degree

Admission Requirements

The normal requirement for admission to a master's program is a bachelor's degree with at least high

honours standing in electrical engineering or a related discipline.

Program Requirements

The requirements for course work are specified in terms of credits: one credit = one hour/week for one term. Subject to the approval of the departmental chair, a student may take up to half of the course credits in the program in other disciplines (e.g., Mathematics, Computer Science, Physics). At the University of Ottawa, master's programs with a thesis earn the Master of Applied Science degree, while other master's programs earn the Master of Engineering degree. At Carleton University, all master's programs earn the Master of Engineering degree.

Master's Degree by Thesis
- eighteen course credits plus thesis

Master's Degree by Course Work
- twenty seven course credits plus a project (nominally six credits)

Cooperative Master's Degree by Thesis
- eighteen course credits plus a thesis

Cooperative Master's Degree by Course Work
- twenty four course credits plus two projects (each conducted in one work term)

Participation in the cooperative master's program is subject to acceptance by a suitable sponsoring organization.

Doctor of Philosophy

Admission Requirements

The normal requirements for admission into the Ph.D. program is a master's degree with thesis in electrical engineering or a related discipline.

Program Requirements

The requirements for course work are specified in terms of credits: one credit = one hour/week for one term. Subject to the approval of the advisory committee, a student may take up to half of the course credits in the program in other disciplines (e.g., Mathematics, Computer Science, Physics).
- A minimum of fourteen course credits
- A comprehensive examination involving written and oral examinations and a written thesis proposal, to take place before the end of the fourth term of registration
- A thesis which must be defended at an oral examination

Graduate Courses

In all programs, the student may choose graduate courses from either university with the approval of the adviser or advisory committee. Course descriptions may be found in the departmental section of the calendar. All courses are of one term duration. Only a selection of courses listed is given in a particular academic year. The following codes identify the department offering the course.

Carleton University
94	Department of Systems and Computer Engineering
97	Department of Electronics

University of Ottawa
92   Department of Electrical Engineering
The CSI designation refers to the Department of Computer Science at the University of Ottawa. The ELG designation refers to the Department of Electrical Engineering at the University of Ottawa.

Department of Electronics

Mackenzie Building 417
Telephone: 788-5754
Fax: 788-5708

The Department

Chair of the Department:
J.S. Wight
Associate Chair, Graduate Studies:
N.G. Tarr

Programs of study and research leading to the master's and Ph.D. degrees in electrical engineering are offered through the Ottawa-Carleton Institute for Electrical Engineering. The Institute, established in 1983, combines the resources of Carleton University and the University of Ottawa. For further information, including admission and program requirements, see page 126.

The Department of Electronics is concerned with the fields of applied and physical electronics. Effort is strongest in four broad areas: computer-aided design for electronic circuits; physics and fabrication technology for solid-state electronic and photonic devices; VLSI and high-speed analog integrated circuits; and microwave and photonic subsystems and circuits. Specific areas of specialization include:

Computer-Aided Circuit Design
Development of hierarchical simulators for mixed analog/digital circuits; analysis and design of switched-capacitor networks; analysis and design of high speed circuits; optimization techniques; synthesis of VLSI circuits using both algorithmic and knowledge-based approaches; analysis and simulations of communications systems links; layout synthesis and module generation

Phototonic Devices
Waveguides and holographic optical elements for optical interconnects; electro-optic modulators and switches; waveguides for sensing applications.

Solid State Devices
Fundamental semiconductor device physics; device design and novel device structures; device modelling for CAD; new fabrication processes; submicron and quantum effect devices; photovoltaics; semiconductor sensors and transducers

Integrated Circuit Engineering
Design and development of linear and digital integrated circuits; fabrication processes and test techniques; MOS, bipolar and BiCMOS ICs; VLSI; computer-aided circuit design

Analog Signal Processing
Switched-capacitor filters, transversal filters, operational amplifiers and radio frequency functions in analog signal processing applications, particularly for integrated circuit realization

Circuits
Active filters; linear and nonlinear circuit design; computer-aided circuit design; phase-locked circuits, carriers and clock synchronizers; mixers, modulators and demodulators

Microwave Electronics
Microwave amplifiers, oscillators, modulators, frequency converters, phase-shifters; use of FET and bipolar transistors, Schottky barrier, varactor, step recovery and PIN diodes; design using finline, microstrip, stripline, coax, and waveguide; monolithic microwave ICs in GaAs; miniature hybrid microwave ICs

Communications and Radar Electronics
Circuits for terrestrial and satellite communications; circuit implementation of digital modulation techniques; antenna and array design; communication channel characterization; optical communications circuits; radar transmitter and receiver design

Biomedical Electronics
Cochlear prosthesis

NSERC/BNR Chair in CAD
The joint Natural Sciences and Engineering Research Council/Bell Northern Research Chairs in Computer-Aided Design are currently held by Dr. Michel Nakhla and Dr. Q.J. Zhang. This is part of a planned expansion of the department in the area of CAD for VLSI.

NSERC/OCRI Chair in High Speed Integrated Circuits
The joint Natural Sciences and Engineering Research Council/Ottawa-Carleton Research Institute Chair in High Speed Integrated Circuits is currently held by Dr. W.M. Snelgrove.

TRIO
The Department is part of the TRIO (Telecommunications Research Institute of Ontario) Centre of

Excellence. Current research areas of the Centre with major participation from the Department are: integrated services digital networks, mobile and portable wireless networks, VLSI in communications, and millimetre wave/optical antennas and circuits for personal communications.

Micronet

The Department is a member, along with seven other Canadian universities and several major industrial organizations, of Micronet, the federally-sponsored network on Microelectronic Devices, Circuits and Systems for ULSI (ultra-large scale integration). Within the Department Micronet supports research on: device structures, modelling and fabrication processes for submicron CMOS and BiCMOS ICs; high-speed filters, phase detectors, A-to-D converters, frequency synthesizers and other circuit elements for silicon ICs operating at radio frequencies; analysis and optimization of interconnects for high-speed ICs; and automated generation of custom cells for VLSI design.

Course Offerings

The structure of the courses offered allows a well-integrated master's or Ph.D. program of study to be chosen appropriately related to the field of thesis research. Device- and integrated-circuit-oriented courses cover: fabrication, semiconductor device theory, semiconductor device design, integrated circuit design and integrated circuit reliability. Circuit-oriented courses include: signal-processing electronics, micro-processor electronics, computer-aided circuit design, phase-locked circuits, filter circuits, RF and microwave circuits, antenna and array design. Systems-oriented courses cover: optical fibre communications and radar systems.

IC Fabrication Facilities

Excellent facilities are available for the fabrication of solid state devices and integrated circuits for research purposes. These include a class-100 clean room in which all basic processes required in silicon mono-lithic technology can be carried out. The clean room houses facilities for photomask generation and pho-tolithography, modern diffusion furnaces, a rapid thermal annealer, low-pressure chemical vapour deposition systems, ECR and reactive ion etchers, e-beam, RF and magnetron sputtering systems for metal deposition, and a SEM. Equipment for thick film deposition, scribing, bonding, and automatic testing is also available. Comprehensive test facilities are available for IC characterization, including wafer probers, HP4145 Semiconductor Parameter Analyzers and an automated C-V measurement station.

Computing Facilities

The Department has excellent computing facilities available for both circuit design and software develop-ment, including facilities for IC design and layout on the silicon chip, allowing IC fabrication either through the Canadian Micro-electronics Corporation or in house. The graduate CAD laboratory consists of twenty-five SUN workstations interconnected via ETHERNET. Industry standard IC design, layout and synthesis software such as EDGE, Synopsys, HSPICE, SILOS, Verilog and VHDL is available, along with the process and device simulation tools SUPREM, SEDAN, Bipole, PISCES and MINIMOS. The Department also has a full COMMON LISP develop-ment system running on the SUN network.

Measurement Facilities

Advanced instrumentation is available supporting automated testing of both analog and digital inte-grated circuits at frequencies up to 2 GHz. Low noise test facilities include a phase noise measurement system, dynamic signal analyzers, spectrum analyzers, network analyzers, arbitrary waveform generators, digital sampling oscilloscopes, digital data analyzers and generators, and RF frequency synthesizers, all of which may be controlled using the IEEE 488 interface.

The Department has up-to-date facilities for circuit development and measurement at microwave frequen-cies ranging up to 22 GHz. There are also facilities for work at optical frequencies. Thin-film micro-wave integrated circuits can be fabricated in house; there is provision for the fabrication of GaAs MMICs through foundry services. Special purpose microwave equipment includes automated network analyzers, spectrum analyzers and frequency synthesizers, and a complete microwave link analyzer. Data generators and error-detection equipment is available for work on digital communications. Industry standard software, such as SERENADE (SUPERCOMPACT, HARMONICA) and ACADEMY (TOUCHSTONE, LIBRA) is available for the computer-aided design and layout of micro-wave integrated circuits.

The research laboratories maintain extensive collaboration with government and industrial re-search and development agencies in the Ottawa area.

Graduate Courses*

The courses offered by the Department of Electronics are as follows:

- Engineering 97.551F1 (ELG6351)
Passive Microwave Circuits
Review of EM theory for guided waves; transmission lines and waveguides. Propagation in ferrites. Characteristics of planar transmission lines, both single and coupled; stripline, micro-strip, coplanar lines, slotline. Representation of discontinuities in transmission lines and waveguides. Scattering-matrix characterization of microwave junctions and discontinuities. Microwave network analysis. Design theory (including CAD), characteristics, and use of microwave components such as impedance transformers, filters, hybrids, directional couplers, isolators and circulators with particular emphasis on their realization in microwave integrated circuits.
B.A. Syrett.

- Engineering 97.555F1 (ELG6355)
Passive Circuit Theory
General description of networks, leading to matrix representation of n-terminal lumped and distributed networks. Elements of matrix algebra as applied to networks. Properties of network functions; poles and zeros of driving point and transfer functions. Foster and Cauer canonic forms. Synthesis of lossless two-ports, single and double-terminated. Modern filter theory; approximation of characteristics by rational functions; Butterworth and Chebyshev approximations. General parameter filters; graphical design. Elliptic filters, predistortion. Phase response and group delay; all-pass and Bessel filters.
P.D. van der Puije.

- Engineering 97.556W1 (ELG6356)
Simulation and Optimization of Electronic Circuits
Computer simulation and optimization of electronic circuits. Large-scale simulation and optimization techniques. Performance driven, cost driven and profit driven circuit optimization. Introduction to advanced design methodologies: design centreing, tolerance analysis, yield maximization, postproduction tuning. Systematic formulation of real-world problems into optimization. Model parameter extraction of active and passive devices, least pth approximation,

decomposition, sensitivity evaluation, Monte-Carlo analysis. Efficient cascaded analysis and application to VLSI systems. Practical CAD problems and methodology.
Q.J. Zhang.

- Engineering 97.557W1 (ELG6357)
Active Circuit Theory
Characterization of negative resistance one-port networks, signal generation and amplification. Active two-ports; y, z, h, k, chain and scattering parameters. Measurement of two-port parameters. Activity and passivity; reciprocity, non-reciprocity, and anti-reciprocity. Gyrator as a circuit element. Stability, inherent and conditional; power gain of conjugate and mismatched two-port amplifiers. Amplifier gain sensitivity. Oscillators, maximal loading, and frequency sensitivity. Active filter design; gyrator, negative immittance converter (NIC) and operational amplifier used as functional elements. Practical realization of gyrators and NICs. Active network synthesis.
Prerequisite: Engineering 97.555 or equivalent.
P.D. van der Puije.

- Engineering 97.558F1 (ELG6358)
Computer Methods for Analysis and Design of VLSI Circuits
Basic principles of CAD tools used for analysis and design of VLSI circuits and systems. Formulation of circuit equations. Sparse matrix techniques. Frequency and time-domain solutions. MOS and bipolar macro-models. Relaxation techniques and timing analysis. Noise and distortion analysis. Transmission line effects in high-speed designs. Interconnect analysis and crosstalk simulation. Asymptotic waveform estimation. Mixed frequency/time domain techniques. Sensitivity analysis and its application in optimizing circuit performance.
M.S. Nakhla.

- Engineering 97.559F1 (ELG6359)
Integrated Circuit Technology
Survey of technology used in silicon VLSI integrated circuit fabrication. Crystal growth and crystal defects, oxidation, diffusion, ion implantation and annealing, gettering, chemical vapour deposition, etching, materials for metallization and contacting, and photolithography. Structures and fabrication techniques required for submicron devices. Applications in advanced CMOS and BiCMOS processes.
N.G. Tarr.

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* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• Engineering 97.562W1 (ELG6362)
Microwave Semiconductor Devices and Applications
Review of basic semiconductor physics, PN junctions and Schottky barriers. Discussion of basic principles of operation, characteristics and applications of varactor diodes (tuning, parametric amplifiers, frequency multipliers), p-i-n diodes (switches, limiters, attenuators, phase shifters), IMPATT and Gunn diodes (negative resistance amplifiers and oscillators), microwave bipolar transistors and MESFETs (amplifiers and oscillators). Design theory (including CAD) of amplifier matching networks. Discussion of microwave device/circuit fabrication technology (discrete, hybrid, monolithic).
B.A. Syrett.

• Engineering 97.563W1 (ELG6363)
Electromagnetic Wave Propagation
Review of groundwave, skywave and transionospheric propagation modes relevant to radar, communications and other systems operating in the medium frequency to extra high frequency bands. The occurrence and magnitude of various types of electromagnetic noise: physical principles involved, modelling and prediction techniques, and limitations of such techniques in practical situations.

• Engineering 97.564W1 (ELG6364)
Radar Systems
Fundamentals; range equation, minimum detectable signal, radar cross-section, pulse repetition frequency, range ambiguities. Classes of Radar; CW, FM-CW, MTI, tracking, air surveillance, SSR, PAR, MLS, SAR, SLAR, OTH, 3D and bistatic radars. Radar subsystems; transmitters, antennas, receivers, processors, displays, detection criteria; CFAR receivers, noise, clutter, precipitation. Waveform design; ambiguity functions, pulse compression. Propagation characteristics; Earth's curvature, refraction, diffraction, attenuation.
P.C. Strickland.

• Engineering 97.565F1 (ELG6365)
Optical Fibre Communications
Transmission characteristics of and design considerations for multi-mode and single-mode optical fibre waveguides; materials, structures, and device properties of light-emitting diodes and laser light sources; photo-diodes, avalanche detectors; repeater design; coupling devices for fibres; noise generation and measurements; inter-modulation, cross-modulation, and non-linearity characterization; analog systems, digital systems, system design accounting for component signal degradation; data bus systems.
D. Beckett, J. Goodwin, L. Tarof, K. Visvanatha.

• Engineering 97.566F1 (ELG6366)
Phase-Locked Loops and Receiver Synchronizers
Phase-locked loops; components, fundamentals, stability, transient response, sinusoidal operation, noise performance, tracking, acquisition and optimization. Receiver synchronizers: carrier synchronizers including squaring loop, Costas loop, and remodulator for BPSK, QPSK BER performance; clock synchronizers including early/late gate, inphase/midphase, and delay line multiplier; direct sequence spread spectrum code synchronizers including single dwell and multiple dwell serial PN acquisition, delay locked loop and Tau-Dither loop PN tracking; frequency hopped spread spectrum time and frequency synchronization.
Calvin Plett.

• Engineering 97.567F1 (ELG6367)
Antennas and Arrays
Terminology and definitions; radiation patterns, beamwidth, beam efficiency, gain, effective area, aperture efficiency, polarization. Basic antenna categories; pencil, defocused, split, multiple, shaped, scanning beam. Basic antenna types; dipole, horns, paraboloid, offset gridded multi-beam, beam-waveguide Cassegrain, Yagi, log-periodic, helix, lens, array. Aperture fundamentals: Fourier transform, phase errors, stationary phase, Rayleigh range, PWS, Woodward synthesis. Field fundamentals; Maxwell's equations, dipoles, radiation and mutual impedance, duality, slotted waveguide. Reflector antennas; GO, Fermat's principle, GO synthesis, physical optics. Paraboloids, dual-polarized reflector, shaping, Cassegrainian feed, profile errors, multi-beam reflectors. Phased array fundamentals; space factor and immersed element pattern, Z-transform, grating lobe diagram, blind spots, thinned arrays, series/corporate/matrix feed, feed systems and phase shifter design.
P.C. Strickland.

• Engineering 97.568W1 (ELG6368)
Fourier Optics
Generalized 2-D Fourier analysis, Fourier-Bessel transforms. Transfer function of an optical system. 2-D sampling theory. Scalar diffraction theory; Helmholtz equation, Green's theorem, Helmholtz-Kirchoff integral equation. Fresnel-Kirchoff and Rayleigh-Sommerfeld diffraction theories. Fraunhofer diffraction. Eikonal equations. The lens as an optical transformer. Optical imaging. Tomography with non-diffracting sources; Fourier slice theorem, filtered and backprojection algorithm. Tomography with non-diffracting sources; Born and Rytov approximations. Bragg cells and their application in correlators and spectrum analyzers. Holography, volume holograms, computer-generated

holograms, optical elements. Analog optical computing; photorefractives, spatial light modulators. Holographic memories and data storage. Generalized optical processors. Spatial filters; van der Lugt, phase-only, and binary phase-only filters. Optical pattern recognition.
R.G. Harrison.

• Engineering 97.569W1 (ELG6369)
Nonlinear Microwave Devices and Effects
Technology of discrete and integrated nonlinear devices and circuits (MMICs) up to submillimeter frequencies. Device modelling: varistor and varactor devices including Schottky, tunnel and resonant-tunnelling diodes; cryogenic devices including Josephson junctions, and SIS quasiparticle tunnel junctions; active devices including GaAs and InP MESFETs, HBTs and HEMTs. Gunn and optical effects in MESFETs. Simulation of nonlinear microwave circuits: analytical methods for global insight (algebraic harmonic balance, Volterra series, Ritz-Galerkin); numerical methods for design (integration and extrapolation, shooting methods, generalized power-series analysis, numerical harmonic balance, and the almost-periodic Fourier transform. Multivalued solutions, jump phenomena and hysteresis, bifurcations and chaotic behaviour. Practical examples illustrating theoretical aspects: detectors, mixers, modulators, frequency multipliers, frequency dividers.
R.G. Harrison.

• Engineering 97.571F1 (ELG6371)
Optical and Microwave Remote Sensing Instrumentation
Introduction to airborne and remote sensing for environmental monitoring. Interaction of optical and microwave radiation with the Earth's surface and its impact on sensing and instrumentation design and operation. Airborne platform motion compensation schemes and their application to geometric correction of airborne imagery. Passive and active electro-optical senors. Radar systems: clutter measurement; scatterometers, real aperture strip mapping radar (SLAR); synthetic aperture strip mapping radars (SAR).
C.E. Livingstone and members of the Department.

• Engineering 97.572F1 (ELG6372)
Optical Electronics
Generation, manipulation and transmission of optical radiation, with emphasis on fundamental principles. Applications in optical sensing, optical communications and optical computing. Electromagnetic wave propagation in crystals; review of geometric optics; Gaussian beam propagation; optical fibres; dielectric waveguides for optical integrated circuits; optical resonators; optical

properties of materials; theory of laser oscillation; specific laser systems; electro-optic modulators; photorefractive materials and applications; holography; optical interconnects.
B.A. Syrett.

• Engineering 97.577W1 (ELG6377)
Microelectronic Sensors
This course is concerned with the fabrication and physical principles of operation of microelectronic sensors. A large variety of sensors will be studied and the basic fabrication methods used in their production reviewed. The devices discussed will include optical sensors, fibre optic sensors, magnetic sensors, temperature sensors and, briefly, chemical sensors. A substantial portion of the course will be devoted to micro-mechanical sensors.
T.J. Smy.

• Engineering 97.578F1 (ELG6378)
ASICs in Telecommunications
The definition of Application Specific Integrated Circuits is given along with current ASIC technology trends. CMOS and BiCMOS fabrication technologies are compared for their potential use in communications circuits. Circuit building blocks such as amplifiers, switched-capacitor fiters and analog to digital converters are overviewed in the context of their communications applications. An overview of vendor technologies is followed by application examples such as line drivers, pulse shaping and equalization circuits, high-speed data transmission over twisted pair copper cables and mobile radio components and implementation issues. Students are required to submit a related literature study and design a communications integrated circuit component using a standard cell library environment.
T.A. Kwasniewski.

• Engineering 97.579W1 (ELG6379)
Advanced Topics in Electromagnetics
Recent and advanced topics in electromagnetics, antennas, radar systems, microwave devices and circuits, or optoelectronics. The subject material will vary from year to year according to research interests in the department and/or expertise provided by visiting scholars or sessional lecturers.

• Engineering 97.580F1 (ELG6380)
Theory of Semiconductor Devices
Review of solid state physics underlying device mechanisms. Equilibrium and non-equilibrium conditions in a semiconductor. Carrier transport theory. Physical theory of basic semiconductor device structures and aspects of design: PN junctions and bipolar transistors, field effect devices. Current transport relationships for transistors.

Charge control theory. Modelling of device mechanisms. Performance limitations of transistors.
T.J. Smy.

• Engineering 97.582W1 (ELG6382)
Surface-Controlled Semiconductor Devices
Basic theory of the MOS capacitor structure; charge and capacitance relationships; characterization of practical structures. MOSFET theory: classical 1-D analysis, Pao-Sah model, charge-sheet model, saturation region analysis. Small-geometry devices, scaling theory. Dynamic behaviour of MOSFETs: quasi-static models, capacitance characterization. Device modelling for CAD.
D.J. Walkey.

• Engineering 97.583F1 (ELG6383)
Silicon Compilers: Automated IC Synthesis
Various topics related to computer analysis and synthesis of integrated circuits including automatic programable logic array/finite state machines compilers, silicon compilers and automatic test plan generators.
Prerequisite: Some IC design knowledge as given, for example, by Engineering 97.469.
J.P. Knight.

• Engineering 97.584F1 (ELG6384)
VLSI Design
An integrated circuit design course with a strong emphasis on design methodology, to be followed by 97.585 in the second term. The design philosophies considered will include Full Custom design, standard cells, gate-arrays and sea-of-gates using CMOS and BiCMOS technology. State-of-the-art computer-aided design tools are available on a network of SUN workstations.
M.C. Lefebvre.

• Engineering 97.585W1 (ELG6385)
VLSI Design Project
A continuation of 97.584. Students will have reviewed and tested earlier designs in the course, and will initiate their own design of an integrated circuit and submit it for fabrication where the design warrants. This course will require considerable project time in our CAD laboratory.
M.C. Lefebvre.

• Engineering 97.586F1 (ELG6386)
Computer-Aided Design: Circuit Design Aids
This course will cover a variety of computer tools for creating and analyzing integrated circuit designs. The theoretical part of the course will cover the methods and algorithms used in CADENCE, ELECTRIC and/or similar tools. In particular, logic simulation, fault simulation, placement routing, layout verification, and synthesis will be considered.
J.P. Knight.

• Engineering 97.587W1 (ELG6387)
Microprocessor Electronics
This course introduces the student to the analysis and design of a microprocessor-based system, integrating the three design aspects: signal representation and processing, hardware and software. Topics discussed are stochastic processes, digital signal representation (as applied to a microprocessor system design), conversion and arithmetic errors, real-time applications software support, micro-architecture of VLSI systems, innovative modern micro- and DSP-processors, bit slices, A/D and D/A converters, controller chips. Students will be given design examples and prepare their own microcomputer system designs.
Prerequisite: Engineering 97.476 or equivalent.
T.A. Kwasniewski.

• Engineering 97.588F1 (ELG6388)
Signal Processing Electronics
Signal processing from the viewpoint of analog integrated circuit design. CCD's, transversal filters, recursive filters, switched capacitor filters, with particular emphasis on integration of analog signal processing techniques in monolithic MOS ICs. Detailed op amp design in CMOS technology. Implications of nonideal op amp behaviour in filter performance. Basic sampled data concepts, detailed Z transform analysis of switched capacitor filters, oversampled A/D converters and more complex circuits. Noise in analog and sampled analog circuits, including calculation of dynamic range and signal to noise ratio.
M.A. Copeland.

• Engineering 97.589F1, W1 (ELG6389)
Advanced Topics in Electronics
A course dealing with selected advanced topics of recent interest in the broad field of solid state devices, electronic circuits, and electromagnetics. Specified topics to be announced each year. Course usually given on a seminar basis with student presentations on assigned topics.

• Engineering 97.590F1, W1, S1
Engineering Project I
A one-term course, carrying half-course credit, for students pursuing the course work M.Eng. program. An engineering study, analysis and/or design project under the supervision of a faculty member. Results will be given in the form of a written report and presented orally. This course may be repeated for credit.

• Engineering 97.591F2, W2, S2
Engineering Project II
A one-term course, carrying full-course credit, for students pursuing the course work M.Eng. program

or the cooperative M.Eng. program. An engineering study, analysis and/or design project under the supervision of a faculty member. Results will be given in the form of a written report and presented orally. This course may be repeated for credit.

• Engineering 97.596F1, W1, S1
Directed Studies
Various possibilities exist for pursuing directed studies on topics approved by a course supervisor, including the above listed course topics where they are not offered on a formal basis.

• Engineering 97.599F4, W4, S4
M.Eng. Thesis

• Engineering 97.699F, W, S
Ph.D. Thesis

Department of Systems and Computer Engineering

Mackenzie Building 4462
Telephone: 788-5740
Fax: 788-5727

The Department

Chair of the Department:
S.A. Mahmoud
Associate Chair for Graduate Studies:
J.W. Chinneck

The Department of Systems and Computer Engineering offers programs of study and research leading to the M.Eng. and Ph.D. degrees in Electrical Engineering. These degrees are offered through the Ottawa-Carleton Institute for Electrical Engineering which is jointly administered by the Department of Systems and Computer Engineering and the Department of Electronics at Carleton University, and the Department of Electrical Engineering at the University of Ottawa. For further information, including admission and program requirements, see page 126.

A program leading to the M.Sc. degree in Information and Systems Science is offered in cooperation with the Department of Mathematics and Statistics and the School of Computer Science at Carleton University. This program is more fully described on page 200 of this calendar.

In addition certain faculty members in the Department are members of the Ottawa-Carleton Institute for Computer Science, which offers a program leading to the M.C.S. degree. This program is more fully described on page 181 of this calendar.

The Departmental program centres upon the analysis and design of engineering systems which process and transmit information and have computers as components. Within this context, several interrelated areas of study receive major attention:

Communication Systems
- Computer Communications
- Broadband ISDN Networks
- Portable and Mobile Communication Systems
- — Signal Processing
- — Network Management
- — Software Methods

Computer Systems
- CAD/CASE of Software and Systems
- Real-Time and Distributed Computing
- Software Engineering
- Data Base Systems
- Knowledge-Based Systems
- Image Processing Systems
- Signal Processing Systems
- Robotics Systems

Analysis Techniques
- Modelling and Simulation
- Performance Analysis
- Optimization

An integrated course program provides students with the fundamental material and allows specialization in one or more of the above areas as desired. Work undertaken includes both theoretical studies and the related problems of practicable realizations.

Computing resources play a central role in the research and teaching activities of the Department. The facilities available to students include over 70 SUN workstations, several high performance IBM or HP workstations, and a Dy-4 multiprocessor system, all connected on an Ethernet LAN. There are also numerous networked PCs, some MACs, and specially configured PCs. Laboratories for communications, signal and image processing research include numerous specialized device and test equipment. There are also several robots for robotics and control research.

The Department is a major partner in the Ottawa-Carleton Centre for Communications Research (OCCCR), which is a multidisciplinary interdepartmental research group comprising faculty members, full-time researchers, graduate students, and support staff from both Carleton University and the University of Ottawa. It is part of the Centre for Excellence TRIO (Telecommunications Research Institute of Ontario) and CITR (Canadian Institute for Telecommunications Research). Current research areas of the centres with major participation from the Department are: broadband ISDN access networks, transmission methods for ISDN, methods for telecommunications software, mobile and portable wireless networks, VLSI in communications and network management using artificial intelligence methods, and wireless indoor digital communications.

Full advantage is taken within the Department of the technology-oriented government/industry/university complex in the Ottawa area. Cooperative projects exist with the Department of Communications, Communications Research Centre, NRC, Bell Northern Research Laboratories, Gandalf, Bell Canada and Department of National Defence.

Graduate Courses*

• Engineering 94.501W1 (CSI5120)
Simulation and Modelling
Simulation as a problem-solving tool. Mathematical foundations: random variate generation, parameter estimation, confidence interval, simulation algorithm. Simulation languages: SLAM, SIMULA, SIMSCRIPT. Examples: computers and protocols, urban traffic, harbours and airport capacity planning, manufacturing capacity planning, inventory systems.

• Engineering 94.503F1 (ELG6103I)
Discrete Stochastic Models
Models for software and computer systems, and communications networks, with discrete states, instantaneous transitions and stochastic behaviour. Communicating finite state machines and Petri Nets. Stochastic behaviour leading to Markovian models (including stochastic Petri Nets). Review of concepts of probability, and theory of Markov Chains with discrete and continuous parameters. First-passage problems. Birth-death processes and basic queuing theory. Numerical methods for Markov Models.
C.M. Woodside.

• Engineering 94.504F1 (ADM6371)
Mathematical Programing for Engineering Applications
An introduction to algorithms used for the optimization of complex systems. Topics include linear programing (with duality and post-optimality analysis), nonlinear programing, dynamic programing integer and mixed-integer programing and combinatorial search methods, and network flow programing. Emphasis is on practical algorithms for engineering applications, e.g. VLSI design, message routing, etc.
J.W. Chinneck.

• Engineering 94.505W1 (CSI5150)
Optimization Theory and Methods
A second-level course in optimization theory and computer-oriented optimization methods. Lagrange's method of undetermined multipliers. Unconstrained optimization: steepest-descent, Newton-Raphson, conjugate gradient, variable metric, and Powell-Zangwill methods. Nonlinear programing: Kuhn-Tucker conditions, saddle point theory and dual problems, computational techniques. Application to nonlinear engineering system identification, network synthesis problems, filter design. Function space techniques and introduction to optimal control.
Bernard Pagurek.

• Engineering 94.506W1 (ELG6106I)
Design of Real-Time and Distributed Systems
Real-time and distributed systems: characteristics, issues. Requirements and architectures will be represented using timethreads. Decomposing and recomposing timethreads and architectures. Analyzing designs for robustness, modularity, extensibility, adaptability. Equivalent more detailed formal representation and analysis using LOTOS and Petri Nets. Adding performance information and analyzing performance, e.g. with timed Petri Nets. Principles for performance engineering. Implementation issues. Tools. Major course project.
Prerequisites: Engineering 94.333 and 94.485 or similar experience.
R.J.A. Buhr.

• Engineering 94/95.507F1 (CSI5307)
Expert Systems
This course will include: survey of some landmark expert systems; types of architecture and knowledge representation; inferencing techniques; approximate reasoning; truth maintenance; explanation facilities; knowledge acquisition. A project to implement a small expert system will be assigned.
Prerequisite: Computer Science 95.407 or 95.501 or permission of the Department.
W.R. Lalonde.

• Engineering 94.511W1 (ELG6111)
Computer System Design for Performance
Methods for deriving quantitative design parameters within an architectural and configuration framework to meet design requirements on performance parameters, such as the throughput capability or response time of a system. Applications to embedded systems (signal processors, switches, etc.), multi-user systems, tightly and loosely coupled distributed processors.
Prerequisites: Engineering 94.553 or ELG5119 and 94.574 or equivalent, and a course in computer architecture.
C.M. Woodside.

• Engineering 94.517W1 (ELG6117)
Queuing Systems
Stochastic processes: Markov chains, discrete birthdeath, etc. Queuing systems: M/G/1, G/M/m, M/M/m/k/n queues, etc. Priority queues. Networks of queues: local/global balance equations, product form solutions for open and closed networks. Mean

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* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

value analysis, diffusion approximation, non-product form networks. Related models (e.g. Petri nets). Numerical solutions. Examples include throughput analysis from multiprocessors and computer-communication networks.
Prerequisite: Engineering 94.553 or ELG5119 or the equivalent.
Exclusion: Engineering 92.520(ELG5120).

• Engineering 94.518W1 (ELG6118)
Topics in Information Systems
Students participate in a group project designing and developing an expert system of significant size in an organized manner. Specification of the system's aims, design in terms of knowledge representation, knowledge acquisition and knowledge use, prototyping, implementation and testing will all be covered in a mix of lectures, interactive tutorials and project assignments.
Prerequisite: Engineering 94/95.507 or 94.583 or equivalent.

• Engineering 94.519W1 (ELG6119)
Teletraffic Engineering
Congestion phenomena in telephone systems, and related telecommunications networks and systems, with an emphasis on the problems, notation, ter-minology, and typical switching systems and net-works of the operating telephone companies. Analytical queuing models and applications to these systems.
Prerequisite: Engineering 94.553 or ELG5119 or the equivalent.

• Engineering 94.521F1 (ELG6121)
Computer Communication
Types of computer networks, performance criteria. OSI Layered Model with emphasis on transport, network and data-link layers. Examples of public networks. Routing and protocol efficiency. Queuing and analysis of networks. Local area networks, protocols and performance analysis of CSMA-CD, token passing and polling. Introduction to ISDN and broadband networks.
Prerequisite: Undergraduate preparation in proba-bility theory equivalent to 69.352.
Exclusion: Engineering 92.567 (ELG5374).
A.R. Kaye.

• Engineering 94.527W1 (ELG6127)
Distributed Processing Systems
Methods for representing distributed systems such as precedence graphs, communicating state-machine models, and Petri nets. Analysis of distributed system behaviour, based on these models. Protocols. ISO protocol model: transport session, presentation and application levels. Design

examples: interprocess communications, file transfer, factory automation. Resource management.
Prerequisites: Engineering 94.521 or ELG5374; and 94.571 or the equivalent.
Shikharesh Majumdar.

• Engineering 94.531F1 (ELG6131)
System Design with Ada
Notations and methods for the design of real time and distributed systems in an object-oriented manner with particular focus on visual techniques and on temporal behaviour problems and solutions. Uses multitasking Ada as an example target im-plementation technology, but the notations and methods are presented in an Ada-independent manner and are of wider applicability than Ada. Teaches techniques oriented towards Computer Aided Design (CAD) of systems (CAD differs from CASE - Computer Aided Software Engineering in placing more emphasis on analysis of the design at the design level before implementation); aims to give insight into the state of the art in CAD and CASE tools. A principles course, rather than a programing or tool-use course.
Prerequisite: Permission of the Department.
(The course requires background of the kind given by the 94.202/94.303/94.333 course sequence in our undergraduate Computer Systems Engineering program; however, it is not the specifics of that particular course sequence that are prerequisites, but a level of readiness to deal with system design issues.)
R.J.A. Buhr.

• Engineering 94.535F1 (ELG6135)
Representations, Methods and Tools for Concurrent Systems
Selected representations and methods for concurrent systems that are supported by current and emerging CAD/CASE tools are studied, experimented with, and presented by students to the class. This is a colloquium course with most lectures consisting of student presentations/discussions, supplemented from time to time by talks from invited experts on topics of particular interest. In addition to in-class presentations, a final, written report is required from each student. The course is supported by a laboratory containing a selection of interesting tools (such as Statemate, Timebench, MLog, Teamwork, Adagen, a Lotos interpreter, and others).
Prerequisite: Permission of the Department.
Enrolment is limited by laboratory facilities and the colloquium nature of the course.
R.J.A. Buhr.

• Engineering 94.538F1 (ELG6138)
Computer Architecture and Parallel Processing
Introduction to parallel processing; parallel computer structures; memory and input/output subsystems; pipelining and vector processing; array processing; data flow and systolic computations; interconnection networks; software and other design fundamentals; examples.
Prerequisite: Engineering 94.457 or equivalent.

• Engineering 94.541F1 (ELG6141)
Adaptive Control
Analysis of nonlinear dynamic systems with emphasis on stability. Lyapunov and hyperstability theories. Introduction to system identification. The least squares and recursive least squares approaches. Model reference adaptive control. The self-tuning regulator. Issues in parameter convergence and stability. Robustness properties of adaptive systems. Case studies will include applications to process control and robotics. Students will be required to prepare a critical review of the current literature.
Prerequisite: Engineering 94.552 or equivalent.
H.M. Schwartz.

• Engineering 94.542F1 (ELG6142)
Advanced Dynamics With Applications to Robotics
Kinematics of rigid bodies and robot manipulators. Use of the Denavit-Hartenberg principle. Forward and inverse kinematics of manipulators. Momentum and energy principles. Lagrange equations and Hamilton's principle. Dynamics of lumped parameter and continuous systems. Natural modes and natural frequencies. Forced vibrations. General dynamics of robot manipulators.
H.M. Schwartz.

• Engineering 94.552F1 (ELG6152)
Advanced Linear Systems
Review of basic linear systems: input-output relations, superposition, impulse response, convolution. Transform methods in systems analysis. Fourier and Laplace transforms. Time-frequency relationships. Discrete time systems, the Z transform. State space representation of the systems: basic concepts, canonical realizations. Observability and controllability of continuous and discrete time realization. Solution of state equations and modal decomposition. Linear state variable feedback and modal controllability. Abstract approach to state space realization methods. Geometric interpretation of similarity transformations.
H.M. Schwartz.

• Engineering 94.553F1, W1 (ELG6153)
Stochastic Processes
Basic concepts of randomness, as applied to communications, signal processing, and queuing systems; probability theory, random variables, stochastic processes; random signals in linear systems; introduction to decision and estimation; Markov chains and elements of queuing theory.
Exclusion: Engineering 92.519(ELG5119).
A.R. Kaye.

• Engineering 94.554F1 (ELG6154)
Principles of Digital Communication
Elements of communication theory and information theory applied to digital communications systems. Characterization of noise and channel models. Efficient modulation and coding for reliable transmission. Spread spectrum and line coding techniques.
Prerequisite: Engineering 94.553 or ELG5119 or the equivalent (may be taken concurrently).
Exclusion: Engineering 92.556(ELG5375).
M.S. El-Tanany.

• Engineering 94.557F1 (ELG6157)
Fundamentals of Discrete Systems
Introduction to the theory and applications of discrete mathematics to the analysis and design of computer algorithms and data communication systems. Group theory and application to finite state machines; algebras and combinatorial logic design; homomorphic maps and application to group codes; rings and fields and their application to cyclic codes. Graph and tree structures, directed graphs; classes of polynomial and complete and incomplete problems with graph representation.
S.A. Mahmoud.

• Engineering 94.558F1 (ELG6158)
Digital Systems Architecture
New architectural concepts in the design of computer systems are introduced. Discussions include system building blocks (arithmetic units, central processing units, control units, input/output and memory devices) and methods to achieve speed-up (instruction look-ahead, pipe-lining, memory interleaving, associative memory, SIMD and MIMD multiprocessing). Examples of current computer systems are used for discussions.
Prerequisite: Engineering 94.457 or the equivalent.

• Engineering 94.560W1 (ELG6160)
Adaptive Signal Processing
Theory and techniques of adaptive filtering, including gradient and LMS methods; adaptive transversal and lattice filters; recursive least squares; fast recursive least squares; convergence and tracking performance; systolic array techniques. Applications, such as

adaptive prediction, channel equalization; echo cancellation; speech coding; antenna beamforming; system identification in control systems; spectral estimation; neural networks. Students will do extensive reading of current literature and present a seminar.
Prerequisites: Engineering 94.553 or ELG5119 or equivalent; Engineering 94.562 or ELG5376 or equivalent.
D.D. Falconer and T.A. Aboulnasr.

• Engineering 94.561W1 (ELG6161)
Neural Signal Processing
Basic concepts in decision theory and multidimensional function approximation. The least squares adaptive algorithm. The generalized delta rule. Multi-layer perceptrons and the back-propagation algorithm. Approximation of non-linear functions. Radial basis functions. Self-organized maps. Applications of neural signal processing to control, communications and pattern recognition. Software and hardware implementation of neural networks.
Prerequisite: Engineering 94.553 or ELG6153 or equivalent. May be taken concurrently with 94.553.
H.M. Hafez.

• Engineering 94.562F1 (ELG6162)
Digital Signal Processing
Signal representations, Z transform and difference equations. Theory, design of FIR, IIR filters. Discrete Fourier transform: properties, implementation via fast algorithms (radix-m FFT, PFA, WFTA). Chirp-z transform. Cepstral analysis. Decimation/interpolation. Random signal analysis: estimators, averaging, correlation, windowing, Input/output and quantization effects. Application overview: Analog-digital converters (linear, companded), digital audio (CD, DAT), speech analysis and synthesis. Programable DSP microcomputers: contemporary commercial architectures, application to implementation of DSP algorithms. Case studies: Linear predictive coding of speech (LPC), radix/4 FFT, spectograph.
Prerequisite: Engineering 94.553 or ELG5119 or the equivalent (may be taken concurrently).
Exclusion: Engineering 92.557 (ELG5376)
L.R. Morris.

• Engineering 94.563W1 (ELG6163)
Digital Signal Processing Microprocessors, Software and Applications
Digital signal processing (DSP) algorithm structure. Architectural features of general purpose, RISC, and DSP computers. Data representation, addressing, and arithmetic processing. Contemporary single (TMS320C25), dual (DSP56000), and multiple (TM320C30) accumulator/operand commercial architectures. Algorithm/software/hardware

architecture interaction. Programing techniques and program examples. Software development cycle. Hardware and software development tools. Program activity analysis techniques. Case studies: linear predictive vocoder, DFT, Echo cancellation. Interfacing and input/output. Codecs. Micro-programable bitslice processors, application specific chips (ASIC): Pro's/con's versus programable DPS processors.
Prerequisite: Engineering 94.562 or ELG5376 or the equivalent.
L.R. Morris.

• Engineering 94.564W1 (ELG6164)
Advanced Topics in Digital Signal Processing
A course dealing with recent and advanced topics in the field of digital signal processing and its related areas. Students are expected to present one or more seminars.
Prerequisites: Engineering 94.562 or ELG5376 or the equivalent and permission of the Department.
L.R. Morris and R.A. Goubran.

• Engineering 94.565W1 (ELG6165)
Advanced Digital Communication
Digital signalling over channels with intersymbol interference (ISI) and additive Gaussian noise. Error probability analysis. Fading multipath channels as arise in terrestrial Line-of-Sight (LOS) and mobile/portable communications, diversity concepts: modelling and error probability performance evaluation. Synchronization in digital communications. Spread spectrum in digital transmission over multipath fading channels.
Prerequisite: Engineering 94.554 or ELG5375 or the equivalent.
Exclusion: Engineering 92.574(ELG5180)
D.D. Falconer.

• Engineering 94.566W1 (ELG6166)
Introduction to Mobile Communications
Signal strength prediction techniques: propagation models and statistical coverage. Mobile radio channel characterization: statistical characterization of mobile radio fading channel in indoor and outdoor environment, delay spread models and coherence bandwidth, models for digital transmission. Co-channel and adjacent channel interference: interference models, and outage probabilities. Modulation and transmission systems: signal to noise calculations in fading environment, performance of digital systems in fading. Signal processing in mobile radio: diversity and its applications in MRS, impact of diversity on baseband interference, noise and random FM. Adaptive techniques to combat interference and

fading: adaptive equalization and adaptive arrays. Introduction to mobile radio systems.
Co-requisite: Can be taken concurrently with Engineering 94.553 and 94.554.
A.U. Sheikh.

• Engineering 94.567F1 (ELG6167)
Source Coding and Data Compression
Discrete and continuous sources: the rate distortion functions. Discrete source coding: Huffman coding, run length encoding. Continuous source coding: waveform construction coding; PCM, DPCM, delta modulation; speech compression by parameter extraction; predictive encoding; image coding by transformation and block quantization. Fourier and Walsh transform coding. Compression by tree coding. Applications to telecommunication signals and storage; speech, television, facsimile.
Prerequisite: Engineering 94.553 or ELG5119 or the equivalent.
M.S. El-Tanany.

• Engineering 94.568W1 (ELG6168)
Wireless Communication Systems Engineering
Engineering aspect of mobile radio systems: multi-user environment and transmission systems, traffic engineering and system capacity, concept of frequency reuse and channel allocation algorithms. Public and private mobile radio systems and networks: cellular mobil systems, high capacity analog and digital systems, signalling and protocol issues, vehicle location and handover techniques. Cellular systems of the world. Mobile satellite systems: multibeam geostationary and low orbit satellite systems, on-board processing and switching. Personal communications: microcellular architecture, PCN services, bandwidth on demand concept, intelligent network, universal base station and total system integration. Implementation of mobility in network protocols. Indoor high speed data networks: radio LANs and MANs and their interconnection.
Co-requisite: Can be taken concurrently with Engineering 94.553 and 94.554.
A.U. Sheikh.

• Engineering 94.569W1 (ELG6169)
Digital Television
Colour television theory: standard systems; NTSC, PAL, SECAM; composite and component signals. Sampling and quantization of television signals. Bandwidth compression: decimation; predictive, transform and hybrid coding. Digital cameras, studios, switching, special effects, recording, transmission and receivers. Evaluation methods.
D.C. Coll.

• Engineering 94.570W1 (ELG6170)
Spread Spectrum Systems
Fundamentals: jamming, energy allocations, system configurations, energy gain, applications such as antijam, low probability of intercept, multiple access, time of arrival. Antijam systems: parameters, jammer waveforms, uncoded and coded direct sequence BPSK, uncoded and coded binary FSK, interleaver/ hop tradeoff, coder BER bounds, cut-off rates, DS-BPSK and pulse jamming bounds, FH-MFSK and partial band jamming bounds, diversity for FH-MFSK, concatenation of codes. Pseudo-noise generators: statistical properties of M sequences, Galois field connections, nonlinear feed forward logic, DS and FH multiple access design. Code synchronizers: single dwell and multiple dwell serial PN acquisition for DS, delay locked loop and Tau-Dither loop PN tracking for DS, time and frequency synchronization for FH.
T.A. Gulliver.

• Engineering 94.571F1 (CSI5117)
Operating System Methods for Real-Time Applications
Principles and methods for operating system design with application to real-time, embedded systems. Concurrent programing: mechanisms and languages; design approaches and issues; run-time support (kernel); I/O handling. Methods for hard real-time applications. Methods for distributed systems. Programing assignments will be in a suitable programing language.
Prerequisites: Engineering 94.333 or 94.574 or equivalent courses and/or experience. Programing experience in high level and assembly languages.

• Engineering 94.573F1 (CSI5115)
Integrated Database Systems
Database definitions, objectives and applications, standard architectures, e.g. ANSI/SPARC architecture; database design process; data dictionary; the entity-relationship model. Network model; the relational approach, relational algebra and calculus, normal forms; hierarchical model. Design and integration issues in database machines, distributed database and knowledge-based systems.
Prerequisite: Engineering 94.574 or the equivalent.

• Engineering 94.574F1 (ELG6174)
Elements of Computer Systems
An overview of basic computer topics which some engineering students may not have covered in their undergraduate programs. Subjects covered include: concepts in computer architecture: 80X86 architecture, assembler, instruction types, addressing modes, memory organization, and debugging. Structures languages: scope rules, dynamic allocation of data, data types, control structures,

subroutines. Data structures: stacks, queues, linked lists, binary trees. Multitasking operating system concepts: task interference busy waiting, TAS hardware, deadlock, task scheduling and synchronization, semaphores, producer/consumer problem, monitors. This course is designed for graduate students without extensive undergraduate preparation in computer engineering (or the equivalent experience). Students with the equivalent of a bachelor's degree in electrical or computer engineering, or computer science, would normally proceed directly to courses for which 94.574 is a prerequisite.
Prerequisites: Programing experience in at least one high level language and some experience in assembly language programing.

• Engineering 94.576F1 (ELG6176)
Analytical Performance Models of Computer Systems
Analytical modelling techniques for performance analysis of computing systems. Theoretical techniques covered include single and multiple class queuing network models, together with a treatment of computational techniques, approximations, and limitations. Applications include scheduling, memory management, peripheral devices, databases, multiprocessing, and distributed computing.
Prerequisite: Engineering 94.553 or ELG5119 or the equivalent.
C.M. Woodside.

• Engineering 94.577W1 (ELG6177)
Teleprocessing Software Design
Review of teleprocessing applications, functions and devices. The session, presentation and application layers of the Open System Interconnection Model. Examples: Electronic Mail systems and Distributed Data Bases. Teleprocessing Software Design using high level procedural languages: Concurrent Pascal and Ada. SNA protocols and systems: layering concepts in SNA; distribution of teleprocessing functions and software components. Relationship between SNR and OSI models. Examples of Distributed Teleprocessing Networks and applications in SNA.
Prerequisites: Engineering 94.521 or ELG5374 and 94.574 or the equivalents.
S.A. Mahmoud.

• Engineering 94.579F1, W1 (CSI5112)
Advanced Topics in Software Engineering
A course dealing with recent and advanced topics in the field of software engineering and related areas. Primary references are recent publications in the field. Students registered in the course are expected to present one or more lectures or seminars on assigned topics.
Prerequisite: Permission of the Department.

• Engineering 94.581F1 (ELG6181)
Advanced Topics in Computer Communications
Recent and advanced topics in computer-communication networks intended as a preparation for research. Students are expected to contribute to seminars or present lectures on selected topics.
Prerequisites: Engineering 94.521 or ELG5374 or equivalent and permission of the Department.
A.R. Kaye.

• Engineering 94.582F1 (ELG6182)
Introduction to Information and System Science
An introduction to the process of applying computers in problem solving. Emphasis is placed on the design and analysis of efficient computer algorithms for large, complex problems. Applications in a number of areas are presented: data manipulation, databases, computer networks, queuing systems, optimization.
(Also offered as Mathematics 70.582, Computer Science 95.582 and Information and Systems Science 93.582)

• Engineering 94.583W1 (ELG6183)
Logic Programing
Review of relational databases, first order predicate calculus, semantics of first order models, deductive querying. Proof theory, unification and resolution strategies. Introduction to Prolog, and/or parallelism and Concurrent Prolog. Applications in knowledge representation and rule based expert systems.
Bernard Pagurek.

• Engineering 94.584F1, W1 (ELG6184)
Advanced Topics in Communications Systems
Recent and advanced topics in communications systems. Students registered in the course are expected to present one or more lectures or seminars on assigned topics.
Prerequisite: Permission of the Department.

• Engineering 94.585W1 (ELG6185)
Logic Programing: Techniques and Applications
Advanced programing techniques for selected applications of logic programing: language translators, interpreters, expert systems. Prolog language: review of basic logic programing techniques, language features, date representation. Program design; design principles, graphics design notation, paradigms, and methodology. Advanced techniques include: searching, grammars, meta-interpreters, incomplete structures. Implementation of Prolog. Each student is expected to complete a

substantial project as part of the course requirements.
Prerequisite: Engineering 94.583 or the equivalent. (Students are expected to be familiar with Edinburgh-style Prolog).
G.M. Karam.

• Engineering 94.586F1 (ELG6186)
Object Oriented Design of Real-Time and Distributed Systems
Conceptual views of OO and RTD software at different scales of resolution. Principles of software architectures: "wired" and "wireless" architectures; factored architectures; contracts, protocols, threads; concurrency and real-time issues; visualization; notations; relation to OO and RTD domains. Threaded OO design process with examples. Implications for designing evolving systems. Relationship to OO and RTD implementation technologies, to textbook OO and RTD notations, and to current commercial and emerging tools.
Prerequisite: Permission of the Department. The course expects a familiarity with real-time systems and design issues typified by the 94.202/94.303/94.333 undergraduate courses. Some familiarity with OO concepts and at least one OO programing language is highly desirable but not required.
R.J.A. Buhr.

• Engineering 94.587F1, W1, S1 (ELG6187)
Advanced Topics in Computer Systems
Recent and advanced topics in computer systems. The course will generally focus on one or more of the following areas: specification, design, implementation, and modelling/analysis. Students may be expected to contribute to lectures or seminars on selected topics.
Prerequisite: Permission of the Department.

• Engineering 94.588W1 (ELG6188)
Communications Network Management
Overview of network management issues, WANs and LANs. The Internet and ISO models of network management. Network management protocols SNMP, CMIP, CMOT, etc. Events, Managed Objects, and MIBs. Fault management techniques, models and algorithms. Current diagnostic theory and its limitations. AI and machine learning approaches. Monitoring and fault management tools, examples, Recent products.
Prerequisite: Engineering 94.521 or equivalent.
Bernard Pagurek.

• Engineering 94.590F1, W1, S1
Systems Engineering Project
Students pursuing the non-thesis M.Eng. program will conduct an engineering study, analysis, and/or design project under the supervision of a faculty

member. Results will be given in the form of a typewritten report and presented at a departmental seminar.

• Engineering 94.591F2, W2, S2
Systems Engineering Project
Project similar to Engineering 94.590, but either of greater scope or longer duration. Results will be given as a typewritten report and presented in a seminar.

• Engineering 94.593F2, W2, S2
Cooperative Program Project
A one-term course, carrying a full-course credit, for students pursuing the cooperative M.Eng. program. An engineering study, analysis, and/or design project under the supervision of a faculty member. Results will be given in the form of a written report and presented orally. This course may be repeated for credit.

• Engineering 70/94/95.595F4, W4, S4
M.C.S. Thesis

• Engineering 94.596F1, W1, S1 (ELG6196)
Directed Studies

• Engineering 70/93/94/95.598F3, W3, S3
M.Sc. Thesis in Information and Systems Science

• Engineering 94.599F4, W4, S4
M.Eng. Thesis

• Engineering 94.699F, W, S
Ph.D. Thesis

Department of Electrical Engineering

University of Ottawa
161 Louis Pasteur
Colonel By Hall
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The Department

Chair of the Department:
G.I. Costache
Graduate Program Coordinator:
P.A. Galko

The Department of Electrical Engineering is one constituent of the Ottawa-Carleton Institute for Electrical Engineering. Consult the Institute entry on page 126 of this calendar for a faculty list, graduate program descriptions and admission requirements.

Department Facilities

Computing Facilities
1) A VMS Cluster consisting of:
   (a) VAX 3500 server with 8 MB of RAM, and a 800 MB disk
   (b) Eight VAX Station II systems each with 5 MB of RAM, a 200 MB disk and a 19" monitor
2) A Unix network consisting of:
   (a) Two RISC DecServer 3100s each with 24 MB of RAM and a 1 GB disk
   (b) Four RISC DecStation 3100s each with 16 MB of RAM and a 100 MB disk and a 19" colour monitor
   (c) Fourteen RISC DecStation 3100s each with 16 MB of RAM, a 100 MB disk and a 19" monochrome monitor
   (d) Twelve RISC DecStations 2100 each with 8MB of RAM a 100 MB -3disk and a 15" monochrome monitor
   (e) A DecServer 5000 with 40 MB of RAM, and a 2 GB disk
3) Several other Unix-based workstations in various research laboratories (SUN workstations, Compaq 386, HP386, etc.)

In addition to this, the Department operates dozens of IBM compatible and Apple Macintosh family computers. Essentially all of the Department's computers are linked together in a network using Ethernet and LocalTalk networks. The Department's networks connect the University of Ottawa's IBM mainframe and the Internet network.

In addition to these facilities, students in the Department have access to a computer-aided design laboratory operated by the Faculty of Engineering (University of Ottawa). This facility includes 24 networked Silicon Graphics workstations; it is, however, intended primarily for the use of under-graduate students.

Digital Communications Research Laboratory
This laboratory is equipped with a variety of communication system and signal analysis equipment. This includes some of the latest equipment for data source simulation, data error rate monitoring, spectrum analysis, cross and autocorrelation function measurement, probability density function measurement, noise simulation, filtering, etc. It also includes prototype digital modulation and demodulation equipment, and various digital signal processing hardware and software systems based on the TMS320C25 digital signal processor. The laboratory also features a 14/12 GHz satellite earth station and associated terminal equipment for testing prototype equipment on an actual satellite link.

Lightwave Communications Research Laboratory
This laboratory is equipped with modern optical communications instruments covering the wave-lengths from 600 nanometres to 1.5 microns. The laboratory also features several SUN workstations with software for the computer simulation of various aspects of optical communication systems and networks. Current experimental work in the laboratory includes holographic coupler designs, coherent optical networks and indoor infrared multicasting.

Multimedia Communications Research Laboratory
This laboratory is equipped with over 20 UNIX workstations, Macintosh and PC computers inter-connected using FDDI, Ethernet and Appletalk. The laboratory is also equipped with video cameras, video display/capture boards, audio input/output devices and a computer controlled VCR. While UNIX (Solaris, SCO OTD, AIX Linux) is the predominant operating system used in the laboratory, Apple System 7 and Windows NT are also available. Development tools available in the laboratory include various C and C++ compilers, Objectstore OODBMS and a variety of multimedia authoring and programing toolkits.

Electromagnetic Research Laboratory

This laboratory is equipped with modern co-axial line and waveguide instruments covering frequencies from 10 MHz to 60 GHz. A computer-controlled frequency domain network analyzer with error correcting capabilities allows reflection and transmission measurements from 5 Hz to 60 GHz. The laboratory is also equipped with a computer-controlled time domain network analyzer and a modern scalar network analyzer (transmission, reflection test set) as well as various frequency counters and spectrum analyzers. A computer controlled three-dimensional scanning system located in an anechoic chamber and used for near-field antenna measurement in both frequency and time domains over the frequency range from 100 MHz to 3GHz. TEM cells at 100 MHz and 3 GHz are available for field probe calibration and EMC/I testing of electronic equipment.

Graduate Courses

• Engineering 92.505 (ELG5162)
Knowledge-Based Systems: Principles and Design
Basic concepts and terminology. Introduction to mathematical logic and to reasoning. Introduction to Lisp and Objective C. Knowledge representation using rules, semantic nets and frames. Case study. Representation in state space. Case study. Use of knowledge. Procedural and declarative knowledge. Demons. Production systems. Case study. Solution searching algorithms. Expert system components. Inference engine principle. Basic schemes for inference engine representation. Knowledge-based system design. Using an expert system shell for the design of knowledge-based systems. Case study: and expert system for process control.
Dan Ionescu.

• Engineering 92.506 (ELG7132)
Topics in Electronics I
Current topics in the field.

• Engineering 92.507 (ELG7133)
Topics in Electronics II
Current topics in the field.

• Engineering 92.508 (ELG7575)
Sujets choisis en électronique
Sujets d'intérêt courant dans la matière.

• Engineering 92.510 (ELG5163)
Machine Vision
Image acquisition. Lighting considerations. Structured light and stereo ranging. Gray-scale and binary images: geometric and topological properties. Regions and image segmentation. Image preprocessing. Edge finding. Image processing. Image recog-

nition techniques. Mathematical models for image representation. Mathematical morphology. Model building. Representation of 3-D objects. Three dimensional scene understanding. Motion detection. Special vision architectures, massively parallel computers, AIS series. Machine vision for manufacturing.
Prerequisite: ELG4153.
Dan Ionescu.

• Engineering 92.512 (ELG5197)
Introduction to Embedded Systems
The purpose of this course is to present the design alternatives of embedded systems. The course covers the following main topics: overview of embedded systems, where they fit and their general characteristics. Simple embedded systems: sequential event response systems and cyclic executives. Design overview: prototype-based designs, multitasking and multiactivity paradigms. Multitasking systems design: elements of real-time operating systems and harmony. Multiactivity systems design: process activity language (PAL) and PAL-based design tools. As part of the course the students will write a major project on an agreed topic and present it to the class if time permits.
Prerequisite: ELG4161 or the equivalent.
Moshe Kreiger.

• Engineering 92.513 (ELG5198)
Parallel Processing with VLSI
Overview of parallel processing. Architectures for parallel processing: array processors, associate processors, vector processors, orthogonal processors, switch lattice architecture, hypercubes, systolic arrays, wavefront arrays, pyramid structures, data flow architectures, and reduction machines. Memory organization, buses, I/O and interconnection networks for parallel processing systems. Connection machine processing hardware, RISC processors, and some VLSI processors. Impact of GaAs technology on parallel processing. Future parallel processing systems implementations. Some representative parallel processing systems. Examples of parallel processing architectures for various applications.
Sethuraman Panchanathan.

• Engineering 92.514 (ELG5199)
Design of Multimedia Distributed Database Systems
The purpose of the course is to provide the students with the basic concepts of the conventional database technology: technology trends and databases, database concepts and architecture, data modelling. Emphasis will be on the relational technology and distributed databases: relational

concepts, relational algebra, distributed database architecture, horizontal and vertical fragmentations, distribution design, distributed transparency, distributed concurrency control. The course will also examine the new generation of databases for advanced applications such as multimedia information retrieval and the limitations of the conventional models for managing multimedia information such as graphics, text, image, audio/video and voice. Extended relational databases and object-oriented database approaches will be discussed. As part of the course the students will write a major project on topics related to both traditional and advanced database technologies and present it to the class.
Ahmed Karmouch.

• Engineering 92.515 (ELG5373)
Secure Communications and Data Encryption
Introduction to secure communications. Data encryption and encipherment. Source entropy and average mutual information. Cryptanalysis of encrypted data. Classic encipherment methods: substitution, transposition and product ciphers. Symmetric cryptosystems: shift register sequences, stream ciphers and Data Encryption Standard DES. Public key encipherment concept, RSA cipher, knapsack cipher, computational complexity, Diffie-Helman public key distribution scheme. Message authentication and identity verification. Applications: electronic funds transfer, secure speech communications.
Prerequisite: ELG5119 or 94.553 or the equivalent.
J.-Y. Chouinard.

• Engineering 92.516 (ELG5113)
Stochastic Systems
Wiener processes. Poisson random measures. Stochastic Wiener-Ito integrals. Stochastic integrals with respect to Poisson measures. Stochastic differentials. Diffusion processes. Ito-stochastic differential equations: existence and uniqueness of solutions, continuous dependence of solutions with respect to parameters. Semigroup theory and generation of semigroups as applied to stochastic differential equations. Applications to engineering systems modelling (computer communications networks, power system networks, etc.).
Prerequisite: Permission of the instructor.
N.U. Ahmed.

• Engineering 92.519 (ELG5119)
Stochastic Processes
Probability spaces. Random variables. Distribution and density functions. Expectation. Functions of random variables. Moments and characteristic functions. Random vectors. Functions of random vectors. Sequences of random variables. Convergence notions. The central limit theorem. The law of large numbers. Stochastic processes: basic notions, characterizations and examples. Stationarity notions. Poisson processes. Gaussian processes. Transformations of stochastic processes. Ergodicity. Second order random processes. Representation theorems. Markov processes. Homogeneous Markov chains. Applications.
Exclusion: 94.553
P.A. Galko.

• Engineering 92.520 (ELG5120)
Queuing Systems
Stochastic processes: Markov chains, discrete birth-death, etc. Queuing systems: M/G/1, G/M/m, M/M/m/k/n queues, etc. Priority queues. Networks of queues: local/global balance equations, product form solutions for open and closed networks. Mean value analysis, diffusion approximation, non-product form networks. Related models (e.g., Petri nets). Numerical solutions. Examples include throughput analysis from multiprocessors and computer-communication networks.
Prerequisite: ELG5119 or 94.553 or the equivalent.
Exclusion: 94.517
O.W. Yang.

• Engineering 92.527 (ELG5161)
Robotics: Control, Sensing and Intelligence
Robotics as the intelligent connection of perception to action. Robotics in the CIM context. Advanced robotics technologies. Robot arm kinematics and dynamics. Planning of manipulator trajectories. Control of robot manipulators. Robot-level programming. Sensors and sensory perception. Control problems for sensory controlled robotic-based flexible manufacturing systems. Task-level programing. Mobile robots. Knowledge-based control for mobile robots: environment perception, robot's world model, navigation and motion control.
Prerequisite: ELG4161 or the equivalent.
E.M. Petriu.

• Engineering 92.529 (ELG7113)
Topics in Systems and Control I
Current topics in the field, including linear semigroup theory and optimal feedback control.

• Engineering 92.530 (ELG7114)
Topics in Systems and Control II
Current topics in the field, including linear and non-linear filtering and optimal control of stochastic systems.

• Engineering 92.531 (ELG7574)
Sujets choisis en systèmes et réglage automatique.
Sujets d'intérêt courant dans le domaine.

• Engineering 92.535 (ELG5108)
Electromagnetic Compatibility and Interference
Interference phenomena. Shielding of conductors.
Grounding. Other noise reduction techniques. EMI
filters. Noise sources: narrowband and broadband.
Electromagnetic pulse as an interference source.
Modelling EMI/C circuit boards and backplanes.
Prerequisite: ELG4101 or the equivalent.
G.I. Costache and Prakash Bhartia (DREO).

• Engineering 92.538 (ELG7500)
Sujets choisis en électromagnétisme.
Sujets d'intérêt courant dans la matière.

• Engineering 92.541 (ELG5104)
Electromagnetic Waves: Theory and Applications
The homogeneous wave equation. Uniform and
non-uniform plane waves. Inhomogeneous wave
equations. Green's functions. Theory of potentials.
Scattering problems. Numerical methods. Boundary
value problems. Perturbation and variational techniques.
Prerequisite: ELG4101 or the equivalent.
Staff.

• Engineering 92.542 (ELG5379)
Numerical Methods in Electromagnetic Engineering
An introduction into modern numerical methods for
solving electromagnetic field problems. Deterministic
as well as eigenvalue problems will be treated using
the following techniques: finite difference and finite
element techniques, moment methods, sparse
matrix techniques, spectral domain techniques,
hybrid mode analysis, transmission line matrix
simulations. Applications include wire antennas,
waveguides of arbitrary cross-section, micro-strip
and quasiplanar transmission lines, transmission
line discontinuities and computer-aided design
and optimization of microwave components.
Prerequisite: ELG4101 or the equivalent.
G.I. Costache.

• Engineering 92.543 (ELG5504)
Ondes électromagnétiques: théorie et applications
Équation homogène d'ondes. Ondes planes
uniformes et non uniformes. Équation non
homogène d'ondes. Fonctions de Green. Théories
des potentiels. Problèmes de diffraction. Méthodes
numériques. Problèmes avec conditions aux limites.
Méthodes des perturbations et variation.
Préalable: ELG4101 ou l'équivalent.
Staff.

• Engineering 92.544 (ELG7100)
Topics in Electromagnetics I
Current topics in the field.

• Engineering 92.545 (ELG7101)
Topics in Electromagnetics II
Current topics in the field.

• Engineering 92.546 (ELG5779)
Méthodes numériques en génie électromagnétique
Une introduction aux méthodes modernes de
résolution numérique des problèmes électro-
magnétiques. Le cours couvre des problèmes
déterministes et aux valeurs propres. Les méthodes
suivantes seront présentées: différences finies,
éléments finis, analyse dans le domaine spectral,
analyse par modes hybrides, méthode t.l.m. Les
méthodes seront appliquées aux problèmes suivants:
antennes, guides d'ondes à section arbitraire, lignes
microrubans et lignes quasi-planaires, discontinuités
dans les lignes de transmission, conception par
ordinateur de composants hyperfréquences.
Préalable: ELG4101 ou l'équivalent.
G.I. Costache.

• Engineering 92.550 (ELG5371)
Digital Communications by Satellite
Overview of satellite communications. Channel
characterization and link budget calculations.
Transponders: a transponder model, channelization,
frequency plans, processing transponders. Earth station
technology: modems (BPSK, QPSK, MSK, etc.,
coherent versus differential detection), low noise
amplifiers, high power amplifiers. Forward error
correction for satellite links. Propagation and inter-
ference considerations. Satellite access techniques:
FDMA, TDMA, CDMA, random multiple access.
Satellite switching and on-board processing. Network-
ing and Services. Integrated services digital satellite
network. VSAT, MSAT, Intelsat and Inmarsat.
Prerequisite: ELG4171 or the equivalent.
Abbas Yongaçoglu.

• Engineering 92.551 (ELG5170)
Introduction to Information Theory
Introduction to information theory and communica-
tion systems: source coding, channel coding and
data encryption. The measure of information:
entropy, mutual information and average mutual
information. Discrete-source coding: fixed-length and
variable-length codes, stationary sources, ergodic
sources, Markovian sources, the Source-Coding
Theorem. Data compression. The rate-distortion
function. Information estimation: the Neyman-
Pearson Theorem, maximum-likelihood detection,
elementary and asymptotic bounds on performance,
the Chebyshev inequality and the Chernoff bound.
Channel coding: data transmission over discrete
noisy channels, the capacity of discrete memory-
less channels, discrete channels with memory, the
Channel Coding Theorem, block codes and tree
codes. Continuous channels and sources: entropy
and mutual information of continuous-amplitude
discrete-time signals, discrete-time Gaussian sources
and channels with and without memory, the

rate-distortion function of a Gaussian signal, continuous-time Gaussian sources and channels, transmission with a band-width constraint.
Prerequisite: ELG5119 or 94.553 or the equivalent.
J.-Y. Chouinard.

● Engineering 92.553 (ELG5179)
Detection and Estimation
An introduction to the optimal processing of communication signals. The binary hypothesis testing problem. Bayes risk and Neyman-Pearson criteria based receivers. M-ary hypothesis detection problems. Composite hypothesis problems. Parameter estimation criteria; Cramer-Rao bounds; maximum likelihood estimation. Function space concepts. Integral equations; the Karhunen-Loeve Expansion Theorem. Detection problems of signals in additive white Gaussian noise. Detection problems in coloured noise; the whitening filter; singular detection. The noise-in noise problem. Classical signal estimation problems. The liner filtering problem. The Wiener filter. The Kalman filter. Sequential detection (Wald's test). Introduction to non-parametric detection.
Prerequisites: ELG5119 or 94.553; and ELG5375 or 94.554; or the equivalents.
P.A. Galko.

● Engineering 92.554 (ELG5372)
Error Control Coding
General introduction. Algebraic concepts. Linear block codes. Cyclic codes, error trapping, decoding of cyclic codes, BCH codes, majority-logic decoding of cyclic codes, finite geometry codes, burst-error correcting codes. Convolutional codes. Maximum-likelihood decoding, sequential decoding, and majority-logic decoding of convolutional codes. Burst-error correcting convolutional codes. Automatic repeat request strategies. Applications of block coding to data storage systems. Applications of convolutional codes.
Co-requisite: ELG4171 or the equivalent.
Abbas Yongaçoglu.

● Engineering 92.556 (ELG5375)
Principles of Digital Communication
Elements of communication theory and information theory applied to digital communications systems. Characterization of noise and channel models. Analysis of digital data transmission techniques for additive Gaussian noise channels. Efficient modulation and coding for reliable transmission. Spread spectrum and line coding techniques.
Prerequisite: 94.553 or ELG5119 or the equivalent (may be taken concurrently).
Exclusion: 94.554.
P.A. Galko.

● Engineering 92.557 (ELG5376)
Digital Signal Processing
Discrete-time signals, system functions, convolution, correlation, transforms. Frequency domain and Z-domain representations. FIR and IIR filters. Filter design in frequency and time domains. The Discrete Fourier Transform. Fast Fourier Transform algorithms. Realizations: finite word-length effects, quantization of analog signals and filter coefficients; quantization of multiplier and adder outputs, overflow and limit cycles. Decimation and interpolation and their applications. Anti-aliasing filter design. A/D and D/A impairments and specifications. Echo cancellers. The extent to which the above topics are covered will be determined at the beginning of the course based on the student's background.
Prerequisite: ELG5119 or 94.553 or the equivalent.
Exclusion: 94.562
T.A. Aboulnasr.

● Engineering 92.558 (ELG5776)
Traitement numérique des signaux
Méthodes de traitement numérique des signaux dans le domaine fréquentiel et temporel; effets d'arrondissement sur les coefficients et accumulation des erreurs. Réalisations directes à très hautes vitesses. Réseaux systoliques. Réalisations utilisant des micro-ordinateurs. Techniques d'adaptation. Applications aux systèmes de télécommunications.
Préalable: ELG4172 ou l'équivalent.

● Engineering 92.559 (ELG5378)
Image Processing and Image Communications
Linear systems approach to image processing. Two-dimensional transforms for image processing. Image analysis, segmentation, and classification. Applications to inspection, remote sensing, and medicine. Image coding: spatial domain, transform domain. Properties of the human visual system and image displays. Image processing hardware.
Prerequisite: ELG5376 or 94.562 or the equivalent.
S. Panchanathan.

● Engineering 92.560 (ELG7172)
Topics in Signal Processing I
Current topics in the field.

● Engineering 92.561 (ELG7173)
Topics in Signal Processing II
Current topics in the field.

● Engineering 92.563 (ELG7179)
Topics in Signal Processing III
Current topics in the field.

● Engineering 92.565 (ELG7177)
Topics in Communications I
Current topics in the field.

• Engineering 92.566 (ELG7178)
Topics in Communications II
Current topics in the field.

• Engineering 92.567 (ELG5374)
Computer-Communication Networks
Introduction. Network goals. Applications of networks.
Network structure. Network architectures. The ISO
reference model. Introduction to queuing theory.
Delay analysis. The physical layer. The data link
layer. The network layer: point to point networks,
satellite and packet-radio networks, local area net-
works. The transport and session layers: inter-
connection of packet switching networks. The
presentation layer: network security and privacy,
file transfer protocols. The application layer:
distributed data base systems.
Co-requisite: ELG4171 or the equivalent.
Exclusion: 94.521
O.W. Yang.

• Engineering 92.572 (ELG7572)
Sujets choisis en télécommunications et en
traitement de signaux.
Sujets d'intérêt courant dans le domaine.

• Engineering 92.573 (ELG5194)
Design and Testing of Reliable Digital Systems
Introduction. Test generation for combinatorial
circuits. Fault detection in sequential circuits.
Memory testing. LSI/VLSI circuit testing. Deter-
ministic and random testing of digital circuits.
Design for testability. Self-checking circuits.
Design of fault-tolerant systems. Case studies.
Prerequisite: ELG5195 or the equivalent.
S.R. Das.

• Engineering 92.574 (ELG5180)
Advanced Digital Communication
Digital signalling over channels with intersymbol
interference (ISI) and additive Gaussian noise. Error
probability analysis. Fading multipath channels as
arise in terrestrial line-of-sight (LOS) and mobile/por-
table communications, diversity concepts: modelling
and error probability performance evaluation.
Synchronization in digital communications. Spread
spectrum in digital transmission over multipath fading
channels. Optical communications and networking
over fibre and atmosphere. Shot noise, laser
intensity noise and Gaussian noise performance
limits.
Prerequisite: 94.554 or ELG5375 or the equivalent.
Exclusion: 94.565
Mohsen Kavehrad.

• Engineering 92.575 (ELG5195)
Digital Logic Design: Principles and Practices
Combinational circuit analysis including hazard
detection. Number systems and codes. Switching

algebra. Combinational circuit design including
PLA and MSI techniques. IC logic families. Flip-flop
properties. Switching algebra: special properties;
symmetric functions, unate functions, threshold
functions, Boolean difference, and functional
decomposition. Introduction to sequential circuits;
state reduction, incompletely specified machines,
state assignment, and series-parallel decomposition.
Fundamental mode sequential circuits; race,
hazards, and state assignment. Testing aspects of
digital systems; failure and fault models, determin-
istic test generation for combinational circuits, test-
ing sequential circuits, state identification, and test-
ing memories and complex LSI/VLSI circuits. Design
for testability techniques: scan techniques, built-in
self test (BIST), and easily testable network
structures. Semicustom and MSI design. Special
sequential circuits including sequential integrated
circuits.
S.R. Das.

• Engineering 92.577 (ELG5192)
Microprocessor-Based Systems
The course considers the various design alternatives
of microprocessor-based systems. Review of current
microprocessor trends. Design alternatives of micro-
processor-based system executives. LSI memories
and memory system design. Input/output options
and the design of various input/output ports. Busing
schemes. Design of bit-sliced systems.
Prerequisite: ELG4391 or the equivalent.
Moshe Krieger.

• Engineering 92.578 (ELG5193)
Multi-Microprocessor Systems
Multiprocessor systems: definitions, characteristics,
objectives and applications. Multi-microprocessor
systems: what, where and why. Task-driven systems.
Examples of multi-microprocessor systems. (Students
will be expected to do extensive reading of the
current literature, a project and class presentation
of an assigned topic.)
Prerequisite: ELG5192 or the equivalent.
Moshe Krieger.

• Engineering 92.579 (ELG5196)
Automata and Neural Networks: Applications in
Machine Perception
This course is intended to provide a general
introduction to the field of automata networks, giving
special attention to "artificial neural networks" and
their application in modelling perception mechanisms.
Introduction: a historical overview of the area and a
look at examples of automata network applications
in cellular computer architectures, modelling of
physical and biological phenomena, and the
modelling of cognition and perception mechanisms.
Mathematical tools: Boolean networks, discrete

iterative automata, random automata networks, and dynamic automata network behaviour (threshold networks and the behaviour of iterative automata). Neural networks: models for motor control, perception and information retrieval; representation and learning, basic components (the "formal neuron", the perceptron), linear learning, feature discovery by competitive learning, retrieval, multi-layered networks, the "gradient back propagation" learning algorithm for multi-layered networks, and VLSI implementation of a neural network model. Applications in machine perception: self-organization in a perceptual network, the "Adaptive Resonance Theory" of adaptive pattern recognition by a self-organizing neural network, neural networks for adaptive pattern recognition, neural networks for visual pattern recognition, a silicon model of early visual processing and its application to optical flow computing, and a "neural" phonetic typewriter. E.M. Petriu.

- Engineering 92.587 (ELG7186)
Topics in Computers I
Current topics in the field.

- Engineering 92.588 (ELG7187)
Topics in Computers II
Current topics in the field.

- Engineering 92.590 (ELG7573)
Sujets choisis sur les ordinateurs.
Sujets d'intérêt courant dans la matière.

- ELG6000
Engineering Report/Rapport technique
For students in the course work master's program working on the Engineering Report. Pour les étudiants et les étudiantes à la maîtrise qui préparent un rapport technique.

- ELG7999
M.A.Sc. Thesis/Thèse de M.Sc.A.
For students working towards their master's thesis.
Pour les étudiants et les étudiantes qui travaillent à leur thèse de maîtrise.

- ELG8000
Co-Op Work Term I/Travail coopératif 1er stage
For students in a cooperative master's program who are on their first work term.
Pour les étudiants et les étudiantes à un programme coopératif de maîtrise qui font leur première session de travail.

- ELG8001
Co-Op Work Term II/Travail coopératif 2e stage
For students in a cooperative master's program who are on their second work term.

Pour les étudiants et les étudiantes à un programme coopératif de maîtrise qui font leur deuxième session de travail.

- ELG9998
Ph.D. Comprehensive Exam/Examen de synthèse du doctorat
For students undergoing the Ph.D. comprehensive examination.
Pour les étudiants et les étudiantes qui doivent passer l'examen de synthèse du doctorat.

- ELG9999
Ph.D. Thesis/Thèse de doctorat
For students working towards their Ph.D. thesis.
Pour les étudiants et les étudiantes qui travaillent à leur thèse de doctorat.

The Ottawa-Carleton Institute for Mechanical and Aerospace Engineering

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UNIVERSITÉ D'OTTAWA
UNIVERSITY OF OTTAWA

CARLETON UNIVERSITY

The Institute

Director of the Institute:
Stavros Tavoularis

Established in 1984, the Institute combines the research strengths and resources of the Departments of Mechanical and Aerospace Engineering at Carleton University and Mechanical Engineering at the University of Ottawa. Programs leading to master's and Ph.D. degrees are available through the Institute in a range of fields of mechanical and aerospace engineering. Graduate students may pursue their research on either university campus, depending upon the choice of supervisor. Registration will be at the university most appropriate to the student's program of studies and research. Requests for information and applications for admission may be sent to the Director of the Institute.

Members of the Institute

The "home" department of each member is indicated by (C) for the Department of Mechanical and Aerospace Engineering, Carleton University, and by (O) for the Department of Mechanical Engineering, University of Ottawa.

F.F. Afagh, *Dynamics, Vibrations, Solid Mechanics* (C)
M.G. Akben, *Metallurgy, Welding, Hot Working of Metals* (O)
A. Artemev, *Phase Transformations, Solidification Processes* (C)
P.E. Barrington, *Aerodynamics, Aeroelasticity* (C)
J.C. Beddoes, *Physical Metallurgy and Metal Processing* (C)
Robert Bell, *Finite Element Analysis, Stress Analysis, Solid Mechanics, Fracture Mechanics* (C)
M.J. Bibby, *Materials and Manufacturing Engineering, Weld Analysis* (C)
S.C. Cheng, *Heat Transfer, Numerical Methods* (O)
M.C. de Malherbe,* *Design, Manufacturing Engineering Processes* (C)
B.S. Dhillon, *Reliability* (O)

*Adjunct Professor, Adjunct Research Professor

A.E. Fahim, *CAD/CAM, Controls* (O)
R.C. Flanagan, *Dynamics, Internal Combustion Engines* (O)
P.R. Frise, *Fracture Mechanics, Fatigue* (C)
J.A. Gaydos, *Thermodynamics, Continuum Mechanics* (C)
K.R. Goheen, *Controls, CAD/CAM/CIM* (C)
J.A. Goldak, *Computer-Integrated Manufacturing Processes, Finite Element Modelling of Manufacturing* (C)
D.J. Gorman, *Vibrations* (O)
D.C. Groeneveld,* *Heat Transfer, Two Phase Flow* (O)
Y.M. Haddad, *Applied Mechanics, Materials and Design* (O)
W.L. Hallett, *Fluid Mechanics, Combustion* (O)
A.M. Jablonski,* *Structural Dynamics, Engineering Mechanics, Space Dynamics* (C)
Geza Kardos, *Design, Fatigue, Fracture Mechanics, CAD, Composite Materials* (C)
R.J. Kind, *Aerodynamics of Aircraft and Turbomachinery* (C)
James Kirkhope, *Stress and Vibrations, Finite Element Analysis* (C)
A.S. Krausz, *Fracture, Plasticity, Manufacturing*, Professor Emeritus (O)
B.H.K. Lee,* *Aerodynamics, Aeroelasticity* (O)
Y. Lee, *Heat Transfer, Nuclear Engineering* (O)
M. Liang, *Production and Manufacturing Systems* (O)
Julius Lukasiewicz,* *Supersonic and Hypersonic Test Facilities, Energy in Transportation, Fast Passenger Rail* (C)
J.M. McDill, *Adaptive Methods for 3-D Finite Element Analysis* (C)
R.E. Milane, *Combustion, Fluid Mechanics* (O)
Shaukat Mirza, *Vibrations, Stress Analysis* (O)
Hany Moustapha,* *Turbomachinery, Aerodynamics* (C)
M.B. Munro, *Composite Materials* (O)
D.S. Necsulescu, *Control, Robotics, Reliability* (O)
E.G. Plett, *Energy Systems, Fluid Mechanics, Thermodynamics and Heat Transfer, Numerical Modelling* (C)
David Redekop, *Applied Mechanics, Finite Element Analysis, Robotics* (O)
W.G. Richarz, *Aeronautical Engineering, Acoustics, Instrumentation* (C)
J.T. Rogers,* *Heat Transfer, Energy Systems, Nuclear Engineering* (C)
D.L. Russell, *Dynamics, Controls, Robotics* (C)
H.T. Saliba, * *Vibrations* (O)

H.I.H. Saravanamuttoo, *Gas Turbine Performance, Engine Health Monitoring* (C)

J.Z. Sasiadek, *Control Systems, Robotics and Automation, Guidance, Navigation and Control* (C)

H.M. Schwartz, *Automation, Robotics, Controls* (C)

R.J. Singal,* *Structural Dynamics, Space Dynamics* (C)

J.S. Sinkiewicz,* *Robotics, Guidance, Navigation, Space* (C)

S.A. Sjolander, *Aerodynamics, Turbomachinery, Wind-Tunnel Engineering* (C)

D.A. Staley, *Spacecraft Dynamics and Control* (C)

P.V. Straznicky, *Design, Light Weight Structures* (C)

C.L. Tan, *Solid Mechanics, Boundary Integral and Finite Element Methods* (C)

Stavros Tavoularis, *Fluid Mechanics, Experimental Techniques* (O)

W.R. Tyson,* *Materials Processing* (C)

Frank Vigneron,* *Space Dynamics* (C)

George Vukovich,* *Control Systems* (C)

W. Wallace,* *Materials Engineering* (C)

J.Y. Wong, *Vehicle Engineering, Transportation Technology* (C)

M.J. Worswick, *Solid Mechanics, Stress Analysis, Fracture* (C)

M.I. Yaras, *Turbomachinery, Aerodynamics, Computational Fluid Dynamics* (C)

Master's Degree

Admission Requirements
The normal requirement for admission to the master's program is a bachelor's degree with at least high honours standing in mechanical engineering or a related discipline.

Program Requirements
The requirements for course work are specified in terms of credits: one credit is one hour/week for one term (thirteen weeks). The requirements for the master's degree by thesis are:
* Eighteen course credits
* Participation in the Mechanical and Aerospace Engineering seminar series
* Thesis

The requirements for the master's degree by course work are: twenty-seven course credits plus a project equivalent to nine course credits (Engineering 88.598 for Carleton University students; MCG6000 for University of Ottawa students).

Doctor of Philosophy

Admission Requirements
The normal requirement for admission to the Ph.D. program is a master's degree in mechanical or aerospace engineering or a related discipline. Students who have been admitted to the master's program may be permitted to transfer into the Ph.D. program if they show outstanding academic performance and demonstrate significant promise for advanced research.

Program Requirements
The requirements for the Ph.D. degree (from the master's degree) are:
* Fifteen course credits
* Participation in the Mechanical and Aerospace Engineering seminar series
* Successful completion of qualifying examinations
* Thesis. The examining board for all theses will include professors from both departments and an external examiner who is a member of neither university

Students who have been permitted to transfer into the Ph.D. program from a master's program require thirty-three course credits for the Ph.D.

Graduate Courses

In all programs, the student may choose graduate courses from either university with the approval of the adviser or the advisory committee. The available graduate courses are listed below, grouped by subject area. Course descriptions are to be found in the departmental section of the calendar concerned. All courses are of one term duration. Not all courses are necessarily offered during any particular academic year. The following codes identify the department offering the course:

"88" Department of Mechanical and Aerospace Engineering, Carleton University

"89" Department of Mechanical Engineering, University of Ottawa

Thermofluids

88.500	(MCG5300)	Fundamentals of Fluid Dynamics
88.501	(MCG5301)	Theory of Viscous Flow
88.503	(MCG5303)	Incompressible Non-Viscous Flow
88.504	(MCG5304)	Compressible Non-Viscous Flow
88.508	(MCG5308)	Experimental Methods in Fluid Mechanics

88.509	(MCG5309)	Environmental Fluid Mechanics Relating to Energy Utilization
88.521	(MCG5321)	Methods of Energy Conversion
88.522	(MCG5380)	Safety and Risk Assessment of Nuclear Power
88.530	(MCG5330)	Engineering Acoustics
88.531	(MCG5331)	Aeroacoustics
88.532	(MCG5332)	Instrumentation Techniques
88.534	(MCG5334)	Computational Fluid Dynamics of Compressible Flows
88.543	(MCG5343)	Advanced Thermo-dynamics
88.547	(MCG5347)	Conductive and Radiative Heat Transfer
88.548	(MCG5348)	Convective Heat and Mass Transfer
88.549	(MCG5349)	Two-Phase Flow and Heat Transfer
88.570W	(MCG5493)	Special Topics in Mech-anical and Aerospace Engineering — Energy Management
88.570Y	(MCG5495)	Special Topics in Mech-anical and Aerospace Engineering — Micro-gravity or Low Gravity Science
89.511	(MCG5111)	Gas Dynamics
89.531	(MCG5131)	Heat Transfer by Conduction
89.532	(MCG5132)	Heat Transfer by Convection
89.533	(MCG5133)	Heat Transfer by Radiation
89.534	(MCG5134)	Heat Transfer with Phase Change
89.536	(MCG5136)	Special Studies in Fluid Mechanics and Heat Transfer
89.541	(MCG5141)	Statistical Thermodynamics
89.548	(MCG5551)	Théorie d'ecoulement visqueux
89.549	(MCG5552)	Théorie de turbulence
89.550	(MCG5557)	Méthodes numériques en mécanique des fluides
89.551	(MCG5151)	Laminar Flow Theory
89.552	(MCG5152)	Theory of Turbulence
89.555	(MCG5155)	Inviscid Flow Theory
89.556	(MCG5156)	Measurement in Fluid Mechanics

89.557	(MCG5157)	Numerical Computation of Fluid Dynamics and Heat Transfer
89.558	(MCG5158)	Industrial Fluid Mechanics
89.561	(MCG5161)	Environmental Engineering
89.566	(MCG5166)	Nuclear Engineering Fundamentals
89.591	(MCG5191)	Combustion in Premixed Systems
89.592	(MCG5192)	Combustion in Diffusion Systems

Solid Mechanics and Materials

88.517	(MCG5317)	Experimental Stress Analysis
88.550	(MCG5350)	Advanced Vibration Analysis
88.561	(MCG5361)	Creative Problem Solving and Design
88.562	(MCG5362)	Failure Prevention (Fracture Mechanics and Fatigue)
88.563	(MCG5381)	Lightweight Structures
88.565	(MCG5365)	Finite Element Analysis I
88.566	(MCG5366)	Finite Element Analysis II
88.567	(MCG5367)	The Boundary Integral Equation (BIE) Method
88.568	(MCG5368)	Advanced Engineering Materials
88.570H	(MCG5478)	Special Topics in Mech-anical and Aerospace Engineering — Introduction to Random Vibrations
88.570I	(MCG5479)	Special Topics in Mech-anical and Aerospace Engineering — Stability Theory and Applications
88.570J	(MCG5480)	Special Topics in Mech-anical and Aerospace Engineering — Continuum Mechanics with Application to Plasticity
88.570L	(MCG5482)	Special Topics in Mech-anical and Aerospace Engineering — Advanced Space Studies
89.501	(MCG5101)	Theory of Elasticity
89.502	(MCG5102)	Advanced Stress Analysis
89.503	(MCG5103)	Theory of Perfectly Plastic Solids
89.504	(MCG5104)	Theory of Plates and Shells

89.505	(MCG5105)	Continuum Mechanics
89.507	(MCG5107)	Advanced Dynamics with Applications
89.508	(MCG5108)	Finite Element Analysis
89.509	(MCG5109)	Advanced Topics in Finite Element Analysis
89.510	(MCG5110)	Micromechanics of Solids
89.514	(MCG5114)	Analysis and Design of Pressure Vessels
89.517	(MCG5117)	Introduction to Composite Materials
89.518	(MCG5118)	Introduction to Plasticity
89.519	(MCG5119)	Introduction to Fracture Mechanics
89.525	(MCG5125)	Fatigue of Materials and Structures
89.526	(MCG5126)	Deformation of Materials
89.529	(MCG5129)	Hot Working of Metals
89.537	(MCG5137)	Special Studies in Solid Mechanics and Materials
89.538	(MCG5138)	Advanced Topics in Mechanical Engineering
89.580	(MCG5180)	Advanced Topics in Composite Materials
89.581	(MCG5181)	Advanced Vibrations
89.582	(MCG5182)	Theory of Elastic Instability
89.586	(MCG5186)	Non-linear Discontinuous Dynamics and Control

Design and Manufacturing

88.552	(MCG5352)	Optimal Control Systems
88.553	(MCG5353)	Robotics
88.561	(MCG5361)	Creative Problem Solving and Design
88.562	(MCG5362)	Failure Prevention (Fracture Mechanics and Fatigue)
88.570K	(MCG5481)	Special Topics in Mechanical and Aerospace Engineering — Discrete Time Control Systems
88.570U	(MCG5491)	Special Topics in Mechanical and Aerospace Engineering — Computational Metallurgy
88.574	(MCG5374)	Computer Integrated Manufacturing Systems
88.575	(MCG5375)	CAD/CAM
89.515	(MCG5115)	Non-linear Optimization
89.559	(MCG5159)	Advanced Production Planning and Control
89.568	(MCG5168)	Industrial Organization
89.569	(MCG5169)	Advanced Topics in Reliability Engineering
89.570	(MCG5170)	CAD/CAM
89.571	(MCG5171)	Applied Reliability Theory
89.572	(MCG5185)	Multivariable Digital Control
89.573	(MCG5173)	Systems Engineering and Integration
89.576	(MCG5176)	Industrial Control Systems
89.577	(MCG5177)	Robot Mechanics
89.578	(MCG5178)	Advanced Topics in CAD/CAM
89.579	(MCG5179)	Flexible Manufacturing

Transportation Technology

88.510	(MCG5310)	Performance and Economics of Aircraft
88.511	(MCG5311)	Dynamics and Aerodynamics of Flight
88.514	(MCG5314)	Ground Transportation Systems and Vehicles
88.521	(MCG5321)	Methods of Energy Conversion
88.530	(MCG5330)	Acoustics and Noise
88.531	(MCG5331)	Aeroacoustics
88.541	(MCG5341)	Turbomachinery
88.542	(MCG5342)	Gas Turbines
88.570V	(MCG5492)	Special Topics in Mechanical and Aerospace Engineering — Orbital Mechanics and Spacecraft Control
88.570T	(MCG5490)	Special Topics in Mechanical and Aerospace Engineering — Guidance, Navigation and Control

General

88.596	(MCG5395)	Directed Studies
88.598	(MCG5398)	Independent Engineering Study (equivalent to nine course credits)
89.500	(MCG6000)	Mechanical Engineering Report(equivalent to nine course credits)

In addition, graduate courses offered by departments in other disciplines may be taken for credit with approval by the department in which the student is registered.

Department of Mechanical and Aerospace Engineering

Mackenzie Building 3135
Telephone: 788-5684
Fax: 788-5714

The Department

Chair of the Department:
Robert Bell
Associate Chair (Graduate Studies):
E.G. Plett

The Department of Mechanical and Aerospace
Engineering offers programs of study and research
leading to M.Eng. degrees in Aerospace Engineering,
Materials Engineering, and Mechanical Engineering,
and to Ph.D. degrees in Aerospace and Mechanical
Engineering. These degrees are offered through the
Ottawa-Carleton Institute for Mechanical and
Aerospace Engineering, which is jointly administered
by the Department of Mechanical and Aerospace
Engineering at Carleton University, and the Department
of Mechanical Engineering at the University of Ottawa.
For further information, including admission and
program requirements, see page 151.

Programs of research and study are offered in several
areas:
- Aerodynamics and Gas Dynamics
- Heat Transfer
- Stress and Failure Analysis
- Lightweight Structures and Aeroelasticity
- Vibration Analysis
- Computer-Aided Design and Engineering
- Robotics
- Vehicle (Performance and Safety)
- Engineering
- Nuclear Engineering
- Energy Systems
- Energy Conversion and Utilization
- Manufacturing Engineering
- Materials Engineering

The Department has a major research commitment,
both analytical and experimental, to thermofluid-
dynamic and mechanical problems of gas turbine
engine design and operation. Current work includes
flow prediction and analysis in turbo-machines; two-
and three-dimensional boundary layer behaviour; tip-
leakage effects and other losses; dynamics of gas
turbine power plants; design and performance of
highly loaded turbines; engine noise; stress,
deformation, and vibration of compressor and
turbine blades and discs; finite element analysis;

dynamics of high-speed rotors; failure modes of
materials in extreme environments.

Another area of intense research effort in the
Department is computer-aided engineering. Activities
in this field include computer-aided analysis
(including computational fluid dynamics as well as
the finite and boundary element methods), computer-
aided design and computer-integrated manufacturing.
Projects include thermal and mechanical analysis of
welding and casting processes, heat and fluid flow
analyses, stress, deformation (manufacturing processes),
vibration and fracture mechanics studies and solids
modelling. Computer-aided engineering is well
supported by computer hardware and software,
including a state-of-the-art network of engineering
workstations. The Department has a substantial
involvement in the Manufacturing Research Centre
of Ontario.

As part of the faculty interest in transportation,
the Department is active in research on air and
ground vehicle technology. Current studies include
computational methods for steady and unsteady
flows over complex configurations; effects of
roughness on aerodynamic performance; aircraft
noise; boundary layer separation and control;
propeller and rotor aerodynamics and noise. The
Transport Technology Research Laboratory has
been organized for ground transport studies; design
and optimization of off-road vehicles; vehicle
safety; anti-lock braking systems; vehicle-terrain
interaction; effect of vibration on vehicle performance;
dynamics of air-cushion and magnetically levitated
vehicles; composite and structural elements.

Members of the Department are engaged in research
on various aspects of energy conversion, storage
and utilization. In addition to the previously
mentioned work on gas turbines, research is being
undertaken on nuclear energy, effectiveness of energy
end-use, and behaviour in wind of energy-conserving
cladding systems for buildings. In the nuclear energy
field, research is being undertaken in heat transfer
and fluid flow aspects of CANDU and SLOWPOKE
reactors, with a major effort on thermohydraulic
problems in reactor safety. Work is also in progress
on reactor safety in general, with a special emphasis
on risk. Research activities in this field also include
studies on the utilization of CANDU reactors for
thermal energy supply as well as electrical generation
and on applications of up-rated SLOWPOKE reactors
to low-temperature industrial heating and to building
energy needs.

Another area of interest is in design, manufacturing and materials technology; in particular, there are programs on the properties of welded joints, heat treatment and forming studies.

The departmental laboratories are well equipped for the various research activities described above, and these are supported by a machine shop, electronics shop and extensive computing facilities mentioned earlier.

The extensive laboratory facilities of the National Research Council, and of the Department of Energy, Mines and Resources are also used, by special arrangement, for research and graduate studies of mutual interest. Strong contacts are maintained with the gas turbine, aircraft and nuclear power industries.

Graduate Courses*

Only a selection of the courses listed below is given in a particular academic year.

• Engineering 88.500F1(MCG5300)
Fundamentals of Fluid Dynamics
Differential equations of fluid motion. Subsonic flow; potential flow theory; outline of panel methods and flows over wings and bodies. Supersonic flow; oblique shock waves and Prandtl-Meyer expansions, flows over wings and bodies. Viscous flow: the boundary-layer approximation; outline of boundary-layer calculation methods; coupling of viscous and inviscid regions of flow.
Also offered at the undergraduate level, with different requirements, as 87.432, for which additional credit is precluded.
S.A. Sjolander.

• Engineering 88.501W1(MCG5301)
Theory of Viscous Flows
Navier-Stokes and boundary layer equations; mean flow equations for turbulent kinetic energy; integral formulations. Stability, transition, turbulence, Reynolds stresses; separation. Calculation methods, closure schemes. Compressibility, heat transfer, and three-dimensional effects.
R.J. Kind.

• Engineering 88.503F1(MCG5303)
Incompressible Non-Viscous Flow
The fundamental equations and theorems for non-viscous fluid flow; solution of two-dimensional and axisymmetric potential flows; low-speed airfoil and cascade theory; wing lifting-line theory; panel methods.
Miroslav Mokry.

• Engineering 88.504F1(MCG5304)
Compressible Non-Viscous Flow
Steady isentropic, frictional, and diabatic flow; shock waves; irrotational compressible flow, small perturbation theory and similarity rules; second-order theory, unsteady, one-dimensional flow.
W. Carscallen.

• Engineering 88.508W1(MCG5308)
Experimental Methods in Fluid Mechanics
Fundamentals of techniques of simulation of fluid dynamic phenomena. Theoretical basis, principles of design, performance and instrumentation of ground test facilities. Applications to aerodynamic testing (subsonic to hypersonic speeds); wind effects on structures; air and water pollution.
W.G. Richarz.

• Engineering 88.509W1(MCG5309)
Environmental Fluid Mechanics Relating to Energy Utilization
Characteristics of energy sources and emissions into the environment. The atmosphere; stratification and stability, equations of motion, simple winds, mean flow, turbulence structure and dispersion near the ground. Flow and dispersion in groundwater, rivers, lakes and oceans. Physical and analytical modelling of environmental flows.
R.J. Kind.

• Engineering 88.510W1(MCG5310)
Performance and Economics of Aircraft
Aircraft performance analysis with emphasis on factors affecting take-off, landing and economic performance; high lift schemes; operating economics.
Not offered 1994-95.

• Engineering 88.511F1(MCG5311)
Dynamics and Aerodynamics of Flight
Brief review of static stability theory. Euler's equations for rigid body motion; the linearized equations of motion; stability derivatives and their estimation. Longitudinal and lateral dynamic response of an aircraft to control and disturbance.
S. Baillie.

• Engineering 88.514F1(MCG5314)
Ground Transportation Systems and Vehicles
Performance characteristics, handling and directional stability, ride comfort and safety of various types of ground-vehicle systems including road vehicles, terrain-vehicle systems, guided transport systems, and advanced ground transport technology.
References: Wong, J.Y., *Theory of Ground Vehicles, Terramechanics and Off-Road Vehicles.*
J.Y. Wong.

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* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• Engineering 88.517W1(MCG5317)
Experimental Stress Analysis
Introduction to theory of elasticity. Photo-elasticity:
types of polariscopes, two- and three-dimensional
stress fields, frozen patterns. Photoelastic coatings.
Strain gauges; gauge factors, sensitivity, calibration,
and temperature compensation. Moire fringes, brittle
lacquers, mechanical strain gauges.
Robert Bell.

• Engineering 88.521W1(MCG5321)
Methods of Energy Conversion
Technical, economic and environmental aspects of
present and proposed large-scale systems of energy
conversion.
J.T. Rogers.

• Engineering 88.522W1(MCG5380)
Safety and Risk Assessment of Nuclear Power
Safety aspects of nuclear power reactors, particularly
the CANDU reactor. Principles of nuclear power
safety. Probabilistic safety assessment. Analysis of
severe accidents. Nuclear power risks in perspective
with risks of other electrical energy systems.
J.T. Rogers.

• Engineering 88.530F1(MCG5330)
Engineering Acoustics
Review of acoustic waves in compressible fluids;
acoustic pressure, intensity and impedance; physical
interpretation and measurement; transmission
through media; layers, in-homogeneous media, solids;
acoustic systems; rooms, ducts, resonators, mufflers,
properties of transducers; microphones, loudspeakers,
computational acoustics.
W.G. Richarz.

• Engineering 88.531W1(MCG5331)
Aeroacoustics
The convected wave equation; theory of subsonic
and supersonic jet noise; propeller and helicopter
noise; fan and compressor noise; boundary layer
noise, interior noise; propagation in the atmosphere;
sonic boom; impact on environment.
W.G. Richarz.

• Engineering 88.532F1(MCG5332)
Instrumentation Techniques
An introduction for the non-specialists to the concepts
of digital and analog electronics with emphasis on
data acquisition, processing and analysis. Topics
covered include operational amplifiers, signal
processing, digital logic systems, computer interfacing,
noise in electronic systems. "Hands on" sessions
illustrate theory and practice.
W.G. Richarz.

• Engineering 88.534W1(MCG5334)
Computational Fluid Dynamics of Compressible Flows
Following a review of the classification of partial
differential equations as applied to fluid dynamics,
some finite difference formulation techniques are
used to develop the appropriate difference equations.
Solution techniques for parabolic, elliptic and
hyperbolic equations are reviewed and several
approaches are applied to examine the relative merits
of each for the problems of interest, with stability
considered as appropriate. The full complexity of
the Euler and Navier Stokes Equations is approached
in stages. Grid generation techniques are introduced
and the compressible flow of fluids in and around
bodies is solved by several different numerical
approaches.
E.G. Plett.

• Engineering 88.541F1(MCG5341)
Turbomachinery
This course deals with the generalized performance
of turbomachinery, and with the thermo- and aero-
dynamic design of axial and radial flow machines.
The emphasis is on compressible flow machines.
Also offered at the undergraduate level, with differ-
ent requirements, as 88.435, for which additional
credit is precluded.
M.I. Yaras.

• Engineering 88.542W1(MCG5342)
Gas Turbines
Interrelationship among thermodynamic, aerodynamic,
and mechanical design. Ideal and real cycle calculations.
Cycle optimization; turbo-shaft, turbojet, turbofan.
Component performance. Off-design performance;
matching of compressor, turbine, nozzle. Twin-spool
matching.
H.I.H. Saravanamuttoo.

• Engineering 88.543W1(MCG5343)
Advanced Thermodynamics
The course covers three major topics; review of
fundamentals from a consistent viewpoint, properties
and equations of state, and applications and special
topics. The third topic includes an introduction to
statistical thermodynamics.
E.G. Plett.

• Engineering 88.547W1(MCG5347)
Conductive and Radiative Heat Transfer
Analytical, numerical and analog solutions to
steady-state and transient conduction heat transfer
in multi-dimensional systems. Radiative heat exchange
between black, grey, non-grey diffusive and specular
surfaces, including effects of athermanous media.
E.G. Plett.

• Engineering 88.548W1(MCG5348)
Convective Heat and Mass Transfer
Review of analogies between heat, mass and momentum transfer. Free and forced convection from theoretical and experimental viewpoint for laminar and turbulent flows in ducts and over flat plates and blunt bodies. Heat transfer-friction relationship in heat exchangers. Film and dropwise condensation. Boiling with forced and natural convection. Two-phase flow. Mass transfer in stationary, laminar and turbulent flow systems.
E.G. Plett.

• Engineering 88.549F1(MCG5349)
Two-Phase Flow and Heat Transfer
Topics covered include basic equations of liquid-vapour and liquid-gas flows including choked flows and flow oscillations, heat transfer rates and critical heat fluxes. Applications to practical problems are emphasized.
J.T. Rogers.

• Engineering 88.550W1(MCG5350)
Advanced Vibration Analysis
General theory of discrete multi-degree-of-freedom vibrating systems. Emphasis on numerical techniques of solving complex vibrating systems, with selected applications from aeronautical, civil, and mechanical engineering.
James Kirkhope.

• Engineering 88.552W1(MCG5352)
Optimal Control Systems
Review of transfer function and state-space system descriptions. Elements of the optimal control problem. Variational calculus. Optimal state feedback control. Riccati equations. Optimal observers and Kalman-Bucy Filters. Extension to discrete time systems including an introduction to dynamic programing. Practical applications are emphasized throughout the course.
K.R. Goheen.

• Engineering 88.553F1(MCG5353)
Robotics
The history and an introduction to robotics methodology. Robots and manipulators; homogeneous transformation, kinematic equations, solving kinematic equations, differential relationships, motion trajectories, dynamics. Control; feedback control, compliance, servomotors, actuators, external and internal sensors, grippers and vision systems. Microprocessors and their application to robot control. Programming.
J.Z. Sasiadek.

• Engineering 88.561W1(MCG5361)
Creative Problem Solving and Design
This course outlines problem-solving processes and how they can be applied in engineering design. The student will be introduced to and be expected to practice various systematic and creative problem-solving techniques. The emphasis is on the student's learning methodologies rather than accumulating information. The techniques may be successfully applied in any engineering speciality.
(Also offered as Industrial Design 85.531)
Geza Kardos.

• Engineering 88.562F1(MCG5362)
Failure Prevention (Fracture Mechanics and Fatigue)
The course deals with the design of engineering structures to ensure against failure due to fatigue or brittle fracture. It emphasizes an understanding of the nature of fatigue and brittle fracture, and thereby the selection of suitable material, geometry, and inspection procedures for the load and environmental condition intended.
Robert Bell.

• Engineering 88.563W1(MCG5381)
Lightweight Structures
Structural behaviour. Stresses and shear flows in single stroke multicell structures. Bending, twisting of thin-walled beams. Bending of plates. Thin membrane shell structures. Energy principles. Air supported structures. Matrix methods and modal analysis in lightweight structures.
P.V. Straznicky.

• Engineering 88.565F1(MCG5365)
Finite Element Analysis I
An introduction to the finite element methodology, with emphasis on applications to heat transfer, fluid flow and stress analysis. The basic concepts of Galerkin's method, interpolation, numerical integration, and isoparametric elements are taught using simple examples.
J.A. Goldak.

• Engineering 88.566W1(MCG5366)
Finite Element Analysis II
Time marching heat flow problems with linear and nonlinear analysis. Static plasticity. Time-dependent deformation problems; viscoplasticity, viscoelasticity, and dynamic analysis. Isoparametric elements and numerical integration are used throughout.
J.A. Goldak.

• Engineering 88.567F1(MCG5367)
The Boundary Integral Equation (BIE) Method
Introduction to integral equation. Potential theory: Dirichlet and Neumann problems in engineering practice. Two-dimensional BIE for harmonic problems.

Constant line elements. Numerical treatment of BIE. Two-dimensional BIE for elastostatics. Isoparametric line elements. Numerical treatment of BIE and integration schemes. Use of BIE computer programs for solving problems in elastostatics and potential theory.
C.L. Tan.

• Engineering 88.568F1(MCG5368)
Advanced Engineering Materials
This course presents an overview of the mechanical properties of engineering material as a basis for materials selection and design in computer-integrated manufacturing. The first part of the course considers the phenomenological aspects of strength, fracture, fatigue and corrosion/wear, test methods, material properties and use of data-bases. The second part covers the structure and deformation/fracture mechanism of the engineering materials: metals and alloys, ceramics, polymers, rapidly-solidified alloys, surface-modified materials, cellular solids, composite materials. Precludes additional credit for Engineering 88.468.
Prerequisite: Engineering 88.270 or 88.271.

• Engineering 88.570F1, W1
Special Topics in Mechanical and Aerospace Engineering
Courses in special topics related to mechanical engineering and aerospace engineering, not covered by other graduate courses; course details will be available prior to registration.

Topics for 1994-95

• Stability Theory and Applications
Fundamental concepts and common characteristics of modern stability definitions. Sensitivity and variational equations; linear variational equations; phase space; the direct method of Lyapunov; mathematical approximation methods. Application of the theory to stability problems; central force motion, vibrations, control systems, elastodynamics, aircraft, rockets and satellites.
F.F. Afagh.

• Computational Metallurgy
The course will follow the development of microstructure in liquids from solidification through precipitation, grain growth, phase transformations and fracture. The focus will be on computational methods capable of modelling or simulating the evolution of microstructure.
J.A. Goldak.

• Advanced Space Studies
This course in advanced space studies is intended to introduce the student to space technology, space

physics and space life sciences as it relates to manned spaceflight and utilization of the space environment. The course content is based upon that covered by astronauts during their first year of basic training. The subject areas to be covered may include the following: overview of spacecraft design, technical requirements for manned spaceflight, space shuttle systems, space biology and life sciences, fluid physics in microgravity, remote sensing from space, aeronomy, and the mobile servicing system.
Parvez Kumar.

• Guidance, Navigation and Control
Guidance system classification, flight control systems, targeting, target tracking and sensing. Modern multivariable control analysis; design requirements, sensitivity, robustness, perturbations, linearization, qualitative comparison, performance analysis. Modern filtering and estimation techniques, Kalman filter, nonlinear filtering, extending Kalman filter, Kalman filter design and performance, prediction and smoothing. Terrestial navigation; common requirements and design external navigation systems, global positioning systems (GPS), tactical air navigation (TACAN), long-range navigation (LORAN), star trackers. Guidance mission and performance. Navigation and guidance filtering design. Advanced guidance systems. Aircraft, missile and spacecraft guidance and control. Spacecraft altitude and control.
J.Z. Sasiadek.

• Orbital Mechanics and Spacecraft Control
Orbital dynamics and perturbations due to the Earth's figure, the sun and the moon will be studied with emphasis on mission planning and analysis. Rigid body dynamics will be developed and applied to transfer orbit and on-orbit momentum management and control of spacecraft and the effect of flexible structures on a spacecraft control system will be studied.
D.A. Staley.

• Microgravity or Low Gravity Science
This course will examine in detail the transport phenomena that are important in microgravity environments. Topics include capillary effects, transport by diffusion and wetting and absorption phenomena. Comparisons will be made between analytical and ground test results and experiments from space missions.
M.Z. Saghir.

• Continuum Mechanics with Application to Plasticity
This course is intended to provide an introduction to continuum mechanics, primarily from a solid mechanics viewpoint, and elementary plasticity theory. Topics will include: tensors, indicial notation

and tensor manipulation. Continuum descriptions of deformation, strain and stress. Objective tensors. Constitutive relations, elasticity and elementary plasticity. Concept of yield surface, flow potential and normality. Material rate sensitivity. Stress wave propagation.
M.J. Worswick.

• Discrete Time Control Systems
This course covers analysis and synthesis of digital systems and controllers, emphasizing both theory and practical aspects of system analysis and controller design. Topics include relationship between continuous and discrete systems, reachability and related concepts, pulse response and convolution, Z-Transform theory, system sampling, computer control, control system design in state space and frequency domain, stability, implementation issues.
G.S. Vukovich.

• Engineering 88.574W1(MCG5374)
Computer-Integrated Manufacturing Systems (CIMS)
This course presents an overview of the topics essential to CIMS. These include computer graphics, geometric modelling, kinematic analysis, numerically controlled machining, robotics, and flexible manufacturing systems, with the objective of understanding the fundamental data structures and procedures that are appropriate to the computerization of engineering design, analysis and production.
Also offered at the undergraduate level, with different requirements, as 88.474, for which additional credit is precluded.
J.A. Goldak.

• Engineering 88.575F1(MCG5375)
CAD/CAM
Fundamentals of computer-aided design (CAD); review of the design process, elements of computer graphics including hardware and software standards. Wire frames, boundary representations, constructive solids geometry, sculptured surfaces. Data bases. Graphics and product interchange files. Fundamentals of computer-aided manufacturing (CAM): numerical control (NC), CNC, DNC, adaptive control. CAM programming, introduction to popular commercial CAD programs. Management issues including acquisition, training and security.
Also offered at the undergraduate level, with different requirements, as 88.475, for which additional credit is precluded.
Text: Hearn and Baker, *Computer Graphics*
K.R. Goheen.

• Engineering 88.596F1, W1, S1(MCG5395)
Directed Studies

• Engineering 88.598F3, W3, S3(MCG5398)
Independent Engineering Study
In this course, the student pursuing a master's degree by course work will carry out an independent study, analysis, and solution of an engineering problem or design project. The results will be given in the form of a written report and may be presented at a departmental seminar. The study will be carried out under the general direction of a faculty member.

• Engineering 88.599F4, W4, S4
M.Eng. Thesis

• Engineering 88.699F, W, S
Ph.D. Thesis

Other Courses of Particular Interest

Civil and Environmental Engineering
82.511	Introductory Elasticity
82.512	Advanced Elasticity
82.513	Finite Element Methods in Stress Analysis
82.524	Behaviour and Design of Steel Structures
82.534	Intercity Transportation, Planning and Management

Systems and Computer Engineering
94.501	Simulation and Modelling
94.504	Mathematical Programing for Engineering Applications
94.505	Optimization Theory and Methods
94.541	Adaptive Control
94.542	Advanced Dynamics with Applications to Robotics
94.552	Advanced Linear Systems
94.553	Stochastic Processes

Physics
| 75.447 | Statistical Physics |
| 75.511 | Classical Mechanics and Theory of Fields |

Mathematics and Statistics
| 70.486 | Numerical Analysis |
| 70.586 | Numerical Analysis |

School of Industrial Design

Mackenzie Building 3470
Telephone: 788-5672
Fax: 788-4465

The School

Director of the School:
J.R. Giard

The School of Industrial Design does not offer a program at the graduate level. However, it does offer graduate-level courses which can be used towards a degree program in the Department of Mechanical and Aerospace Engineering in the Faculty of Engineering. Members of the school are available to supervise graduate research.

The interests and capabilities of the faculty members lie in the following areas:

User Studies
Applications of ergonomics and anthropometrics in industrial design; study of users from a market perspective.

Form Studies
Form development in industrial design; computer-aided design in industrial design.

Mass Production Studies
Advanced manufacturing methods in industrial design; quality and product life of manufactured goods.

Design Systems and Methods
Research and development in systems and methods as they apply to industrial design.

Contextual Studies
Cultural, social and ethical issues in industrial design.

Graduate Courses*

• Industrial Design 85.500F1, W1
Directed Studies in Industrial Design
Reading and research tutorials.

• Industrial Design 85.531F1,W1,S1
Creative Problem Solving and Design
This course outlines problem-solving processes and how they can be applied in engineering design. The student will be introduced to and be expected to practice various systematic and creative problem-solving techniques. The emphasis is on the student's learning methodologies rather than accumulating information. The techniques may be successfully applied in any engineering specialty.
(Also offered as Engineering 88.561)

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* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.
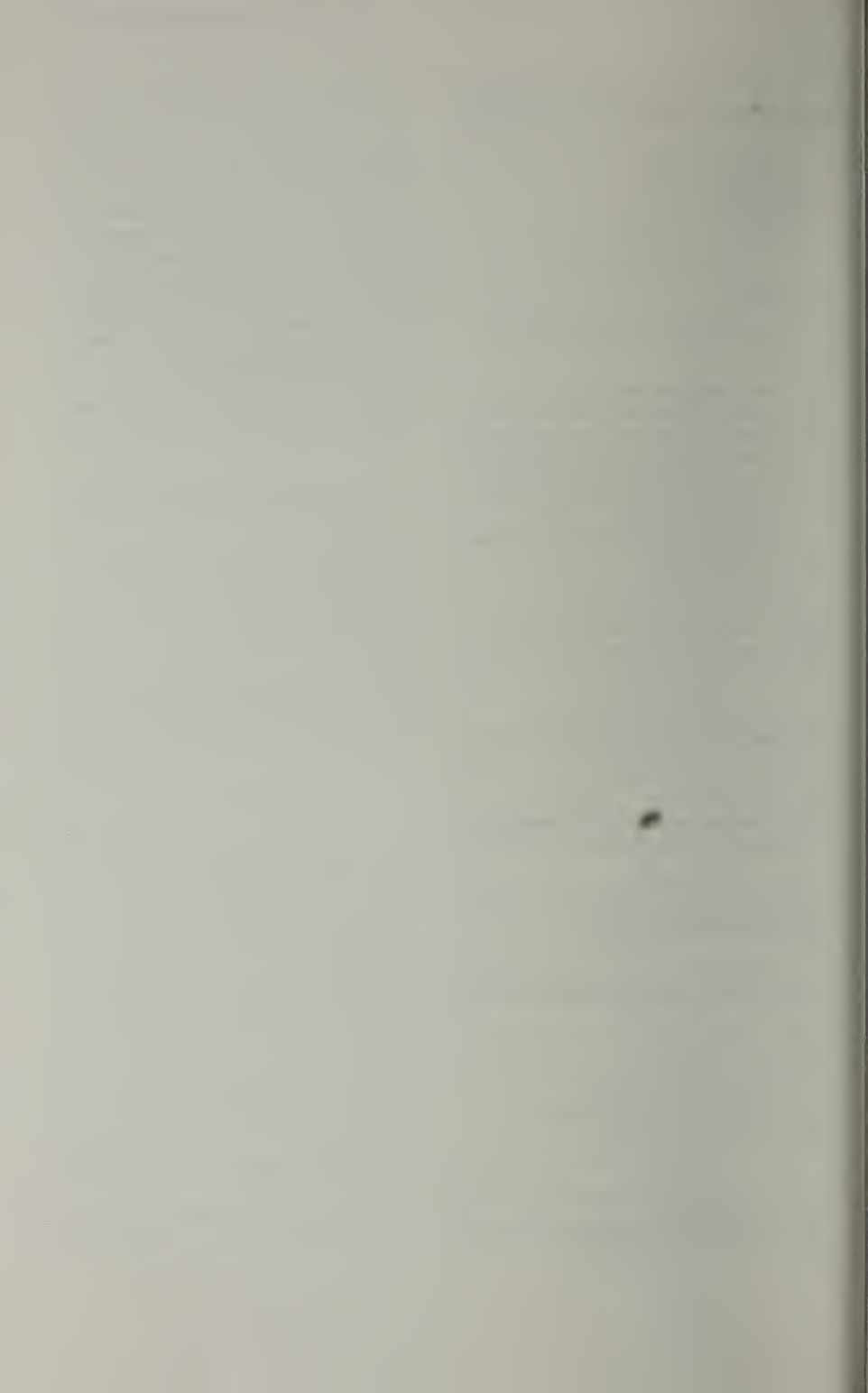
FACULTY OF SCIENCE

Dean D.R. Gardner

Program Descriptions

and

Details of Courses
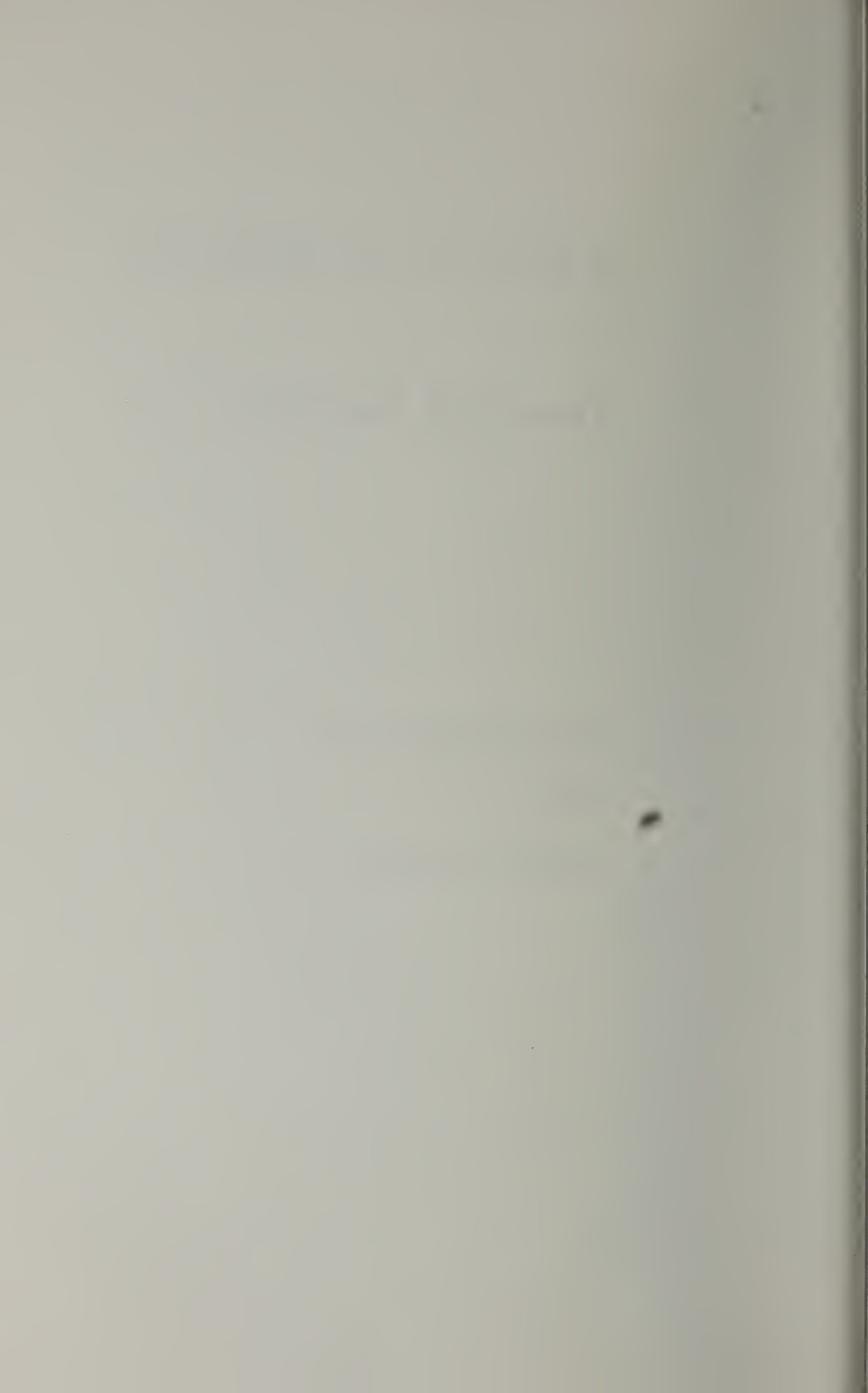
Ottawa-Carleton Institute of Biology

Tory Building 587
Telephone: 788-3888
Fax: 788-4497

UNIVERSITÉ D'OTTAWA
UNIVERSITY OF OTTAWA

CARLETON UNIVERSITY

The Institute

Director of the Institute:
D.J.Currie
Associate Director:
R.C. Wyndham

Students wishing to pursue studies in biological sciences at the M.Sc. and Ph.D. levels in the Ottawa area do so in a cooperative program that combines the resources of the Departments of Biology of Carleton University and University of Ottawa. The two universities have a joint committee supervising the programs, regulations, and student admissions.

Students are admitted for graduate work under the general regulations of the Institute. Additional criteria for admission include academic performance, research experience, and referees' appraisals. The student must also be accepted by a faculty member who will supervise the research project, and the choice of supervisor will determine the primary campus location of the student. The student's advisory committee will normally include faculty members from both universities.

Requests for information, and completed applications should be sent to the director of the Institute, or to the supervisor of graduate studies at either institution.

Members of the Institute
J.B. Armstrong, *Developmental Biology*
J.T. Arnason, *Biochemical Ecology*
C.A. Barlow, *Experimental Ecology*
W.R. Bates, *Developmental Biology*
Linda Bonen, *Molecular Biology*
D.C.W. Brown, *Plant Genetic Engineering*
D.L. Brown, *Cell Biology*
M.J. Canny, *Whole Plant Physiology*
G.R. Carmody, *Population Genetics*
P.M. Catling, *Plant Biosystematics*
Nathalie Chaly, *Cell Biology*
François Chapleau, *Fish Evolution*
Christiane Charest, *Plant Physiology*
R.L. Charlebois, *Microbiology*
D.J. Currie, *Community Ecology, Biogeography*
Hans Damman, *Insect Behavioural Ecology*
J.R. Dillon, *Molecular Genetics*
Guy Drouin, *Molecular Genetics*

Lenore Fahrig, *Population Ecology and Ecological Modelling*
J.M. Farber, *Food Microbiology*
L.B. Flanagan, *Plant Ecology and Physiological Ecology*
J.C. Fenwick, *Comparative Endocrinology*
C.S. Findlay, *Evolution*
D.R. Gardner, *Pesticide, Nerve Interactions*
A.J. Gaston, *Conservation Biology*
S.C. Gleddie, *Somatic Cell Genetics*
W.D. Gould, *Biotechnology*
D.A. Hickey, *Population Genetics*
J.G. Houseman, *Insect Physiology*
H.F. Howden, *Biogeography, Systematics of Insects*
V.N. Iyer, *Bacterial Genetics*
S.L. Jacobson, *Excitable Cell Physiology*
D.A. Johnson, *Molecular Biology*
B.F. Johnson, *Cell Biology of Yeast*
P.A. Keddy, *Plant Ecology*
J.D. Lafontaine, *Insect Systematics*
I.B. Lambert, *Molecular Biology and Genetic Toxicology*
J.D. Lambert, *Plant Communities and Man*
L.R. Lefkovitch, *Mathematical Biology*
M.W. McBurney, *Developmental Biology*
M.E. McCully, *Plant Ultrastructure and Development*
H.G. Merriam, *Woodland Ecosystems*
T.W. Moon, *Comparative Physiology*
Antoine Morin, *Freshwater Ecology*
C.E. Morris, *Physiology of Excitable Cells*
J.M. Neelin, *Nuclear Proteins and Differentiation*
Micheline Paulin-Levasseur, *Cell Biology*
S.B. Peck, *Arthropod and Beetle Evolution Systematics*
S.F. Perry, *Comparative Respiratory Physiology*
B.J.R. Philogène, *Ecophysiology of Insects*
Frances Pick, *Microbial Physiology and Ecology*
Jaroslav Picman, *Behavioural Ecology*
G.P. Raaphorst, *Radiation Biology*
D.J. Rapport, *Environmental Statistics*
V.L. Seligy, *Molecular Genetics*
John Sinclair, *Biophysics of Cells*
K.B. Storey, *Biochemical Adaptations*
J.P. Vierula, *Molecular Biology*
S.I. Warwick, *Plant Systematics*
P.J. Weatherhead, *Behavioural Ecology*
J.A. Webb, *Plant Metabolism*
J.M. Weber, *Metabolic Physiology*
D.M. Wood, *Insect Systematics*
R.C. Wyndham, *Applied Microbiology and Ecology*
Hiroshi Yamazaki, *Bacterial Metabolism, Biotechnology*

Ottawa-Carleton Graduate Specialization in Neuroscience

The Departments of Biology and Psychology at Carleton University, and the Departments of Anatomy, Physiology, and Psychology at the University of Ottawa provide a graduate specialization in neuroscience at the M.Sc. and Ph.D. level. For further details see page 275.

Ottawa-Carleton Collaborative Program in Chemical and Environmental Toxicology

The Departments of Biology and Chemistry at Carleton University and at the University of Ottawa, and the Department of Psychology at Carleton University, provide a collaborative program in chemical and environmental toxicology at the M.Sc. level. For further details see page 173.

Each campus is well equipped for a wide range of biological research; some major equipment and facilities include transmission and scanning electron microscopes, spectrophotometer, liquid scintillation and other radioactivity counters, high performance liquid and gas chromatographs, amino acid analyzer, preparative and analytical ultracentrifuges, electrophysiology equipment, animal and plant growth facilities, controlled environment cabinets, and on-line computer access. Students also benefit from the resources of nearby government laboratories and libraries, for example, Agriculture Canada, Environment Canada, Health and Welfare Canada, and the National Research Council.

Master of Science

Admission Requirements
An honours B.Sc. or equivalent degree at a standard acceptable to the two universities is required for admission to the M.Sc. program. Applicants with acceptable standing in a non-honours degree may be admitted to a qualifying-year program which will be determined in each case by the admissions committee.

Applicants must demonstrate a fluent knowledge of English (Carleton), or either English or French (Ottawa).

Program Requirements
The M.Sc. degree will be conferred upon a candidate who has fulfilled the following requirements:
- Completion of the advanced courses specified by the admissions committee and the student's advisory committee; these will range from one to three full (two-term) courses, depending on the

background and research program of the student. At least one course at the graduate level must be included, and not more than one course at the fourth-year honours level (completed while registered as a graduate student) may form part of the candidate's course requirements. The passing grade for all required courses is 70% or equivalent, and the student is not allowed a supplemental examination. Directed studies or reading courses may not make up more than half of the required numbers of courses. The admissions committee or the student's advisory committee may also direct the student to take or to audit additional courses. Knowledge of a second language may be specified as a requirement
- Completion of at least two terms as a full-time student resident at one of the two universities is normally required. Programs for part-time students may be arranged
- Presentation of one public seminar on the candidate's thesis research
- Completion of a thesis incorporating the results or original research carried out under the direct supervision of an approved faculty member
- Successful oral defence of the thesis before an examination board of at least three faculty members, normally drawn from both universities.

Doctor of Philosophy

Admission Requirements
An M.Sc. from a recognized university is usually required for entry to the Ph.D. program; however, an applicant with a first class B.Sc. and excellent references may be admitted directly to the Ph.D. program. A student already registered for the M.Sc. may be permitted to transfer to the Ph.D. program following a recommendation by the departmental graduate committee and successful completion of the comprehensive examination required of Ph.D. candidates.

All applicants must demonstrate a fluent knowledge of English (Carleton), or either English or French (Ottawa).

Program Requirements
The Ph.D. degree will be conferred upon a candidate who has fulfilled the following requirements:
- Completion of the courses at the graduate level specified by the admissions and advisory committees; these will range from two to four full courses (three to six courses if admitted without an M.Sc.), depending on the background and research program of the student. Only graduate courses may form part of the

candidate's course requirements. The passing grade for all required courses is 70%, and the student is not allowed a supplemental examination. Directed studies or reading courses may not make up more than half of the required number of courses. The admissions committee or the student's advisory committee may also direct the student to take or to audit additional courses. Knowledge of a second language may be specified as a requirement

- Completion of an oral comprehensive examination within approximately twelve months of entry into the program; this examination will cover the candidate's area of research, and general biology. The format of the examination will be established by the departmental graduate committee and approved by the admissions committee. The examination committee will generally be composed of faculty members of both universities
- Presentation of at least one public seminar on the candidate's thesis research
- A thesis incorporating the results of original research carried out under the direct supervision of an approved faculty member
- Completion of at least four terms as a full-time student resident at one of the two universities (or six terms if admitted without an M.Sc.) is normally required. Under exceptional conditions programs may be arranged for part-time students
- Successful oral defence of the thesis before an examination board of at least five faculty members, with representation from both universities, and including an external examiner from outside the two universities who is an authority on the thesis research area

Graduate Courses*

The following courses are offered in the graduate program, but not all are available in any academic year. A list of the courses scheduled for the year is available from the Institute in May.

- Biology 61.501F1 (BIO5101)
Topics in Biotechnology
A course concerned with the utilization of biological substances and activities of cells, genes, and enzymes in manufacturing, agricultural and service

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* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

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industries. A different topic will be selected each year.
Prerequisite: A course in cell physiology or biochemistry, or permission of instructor.
Hiroshi Yamazaki.

- Biology 61.502F1 (BIO8300)
Applied and Industrial Microbiology
A lecture and reading course on the use of microorganisms in industrial processes. Subjects to be covered will include microbial fermentations, enzymology, secondary metabolites, biomass and fuel production.
D.J. Kushner and others.

- Biology 61.503F1 (BIO5103)
Comparative Biochemistry
Advanced topics emphasizing biochemical structures, functions and methodologies in the context of animal (invertebrates and vertebrates) adaptations to environmental stress. The course will be offered in alternate years.
Prerequisite: An undergraduate biochemistry course.
T.W. Moon and K.B. Storey.

- Biology 61.509F1, W1 (BIO8124)
Ontario Vegetation: Patterns, Processes and Protection
Patterns of vegetation and plant species distributions in Ontario will be investigated with respect to their origin and maintaining processes. Current methods of protection of significant and representative vegetation using zonal concepts will be considered.
P.M. Catling.

- Biology 61.510W1 (BIO5301)
Plant Development
An advanced course dealing with selected topics in the experimental study of plant development.
M.E. McCully.

- Biology 61.517T2 (BIO5202)
Molecular Genetics
Development and use of genetic methods in the solution of problems in molecular biology, including discussion of innovations and current efforts of *in vivo* and *in vitro* genetic engineering. Lectures, seminars, laboratory, essays.
Prerequisite: Graduate standing and permission of the Department.
V.N. Iyer.

- Biology 61.521F1 (BIO8301)
Evolutionary Genetics
A lecture/seminar course on the genetic mechanisms and forces responsible for variation and evolutionary change in natural populations. The course will

consider both ecological and molecular questions from an evolutionary perspective. Topics will include protein and genome evolution, molecular phylogenies, DNA sequences in population biology, and the evolution of multigene families.
Prerequisites: Graduate standing plus basic courses in genetics and evolution, and permission of the Department.
(Offered in alternate years; one three hour lecture per week).
Before 1994-95 course 61.521 (BIO8301) was offered as 61.519 (BIO8219).
D.A. Hickey, G.R. Carmody, Guy Drouin and Linda Bonen.

- Biology 61.522W1 (BIO8302)
Topics in Evolutionary Genetics
A lecture/seminar course on further issues of the genetic mechanisms and forces responsible for genetic variation and evolutionary change. Topics will include the evolutionary significance of regulatory, structural and developmental gene variation, concepts of individual, deme and group selection, relationships of micro-evolution to macro-evolutionary trends, the evolution of sex, selfish DNA.
Prerequisite: Biology 61.521F1 (BIO8301).
(Offered in alternate years; one three hour lecture per week).
Before 1994-95 course 61.522 (BIO8302) was offered as 61.519 (BIO8219).
D.A. Hickey, G.R. Carmody, Guy Drouin and Linda Bonen.

- Biology 61.523F1 (BIO8303)
Techniques of Light Microscopy
An advanced laboratory and lecture course on the principles and techniques of light microscopy. One hour lecture per week, five hours laboratory work per week.
Prerequisite: Open to fourth year and graduate students with consent the instructor.
Before 1994-95 course 61.523 (BIO8303) was offered as 61.520 (BIO8238).
D.L. Brown.

- Biology 61.524W1 (BIO8304)
Techniques of Electron Microscopy
An advanced laboratory and lecture course on the principles and techniques of electron microscopy. (One hour lecture per week, five hours laboratory work per week).
Prerequisite: Open to Fourth year and graduate students with consent of the instructor.
Before 1994-95 course 61.624 (BIO8304) was offered as 61.520 (BIO8238).
D.L. Brown.

- Biology 61.525T2 (BIO5204)
Plant Physiology and Metabolism
An advanced course dealing with selected topics in plant physiology and plant metabolism.
Prerequisite: Graduate standing or permission of the Department.

- Biology 61.534T2 (PSY6201)
Basics of Neuroscience
A comprehensive neuroscience course from the membrane and the cellular levels through to the behavioural aspects of invertebrates and vertebrates. Lectures and tutorials will cover such aspects of neuroscience as neuroanatomy, neurophysiology, behavioural neuroscience and neuropharmacology.
(Also offered as Psychology 49.520)

- Biology 61.535T2 (BIO5212)
Special Studies in Physiology
Advances in cellular neurophysiology. Two lectures per week, four hour laboratory and essay assignment.
D.R. Gardner.

- Biology 61.536F1, W1 (BIO9201)
Photobiology
A course dealing with the interaction between light and living organisms, including an introduction to photochemistry, and a detailed study of photosynthesis, vision, photosensitivity, and photoperiodism.
Prerequisite: An advanced course in animal or plant physiology or biochemistry, or permission of the Department.
John Sinclair, J.T. Arnason and B.J.R. Philogène.

- Biology 61.537F1 (BIO8122)
Advanced Insect Physiology
Physiological characteristics of insects. In addition to the course material, students will write two term papers.
J.G. Houseman.

- Biology 61.542T2 (BIO8162)
Developmental Endocrinology/Topics in Comparative Endocrinology
A lecture and reading course concerned with classical as well as current topics in the field of comparative endocrinology. Special emphasis will be placed on the vertebrates. Offered in alternate years.
Prerequisite: An undergraduate course in endocrinology.
J.C. Fenwick.

- Biology 61.545T2 (BIO9202)
Project in Applied Ecology
A course in the form of a special research project in which the student identifies an environmental problem and the corporate or governmental body that has the power to rectify the problem. Work includes: 1) a literature review with a report on this review;

2) a second report, in the form of an article in a newspaper or magazine, to convey the relevant results to non-scientists; 3) an approach to the relevant private or governmental agency with an attempt to have the solution implemented and a detailed report on this experience. (Enrolment limited).
P.A. Keddy.

- Biology 61.546F1 (BIO9303)
Advanced Plant Ecology
Plant population biology, and its usefulness in explaining attributes of plant communities, will be discussed in weekly seminars based on assigned readings. During the labs projects will be carried out to clarify topics such as vegetation classification and competition.
P.A. Keddy.

- Biology 61.547T2 (BIO5205)
Quantitative Ecology
A course on analysis of the distribution and abundance of plants and animals, and of related environmental phenomena. Computer assignments and a major data analysis project will be required.
Prerequisites: Graduate standing, courses in elementary ecology and statistics and permission of the Department.
Lenore Fahrig.

- Biology 61.549T2 (BIO5206)
Mathematical Modelling for Biologists
This course is designed to develop mathematical tools for the modelling of biological processes. The student is taught the necessary mathematics, a computer language, and guidance is given in the choice of simulation of a biological process.
L.P. Lefkovitch.

- Biology 61.550T2 (BIO5207)
Selected Topics
Courses in selected aspects of specialized biological subjects, not covered by other graduate courses; course details will be available at registration.

- Biology 61.551F1 (BIO8104)
Selected Topics in Biology I
Courses in selected aspects of specialized biological subjects, not covered by other graduate courses; course details will be available at registration.

- Biology 61.552W1/S1 (BIO8102)
Selected Topics in Biology II
Courses in selected aspects of specialized biological subjects, not covered by other graduate courses; course details will be available at registration.

- Biology 61.553T2 (BIO5901)
Recent Advances in Biology
A course intended for all first-year graduate students to bring them up to date in the various major areas of biology. The course will consist of selected readings, lectures and invited speakers.

- Biology 61.556T2 (BIO5213)
Advanced Insect/Animal Systematics
A lecture and seminar course concerning methods, roles and advances in systematics of insects and other animals. One research project required.
Prerequisite: A 400-level course in identification or classification of insects or other animals.
H.F. Howden.

- Biology 61.558F1 (BIO8306)
Advanced Population and Community Ecology I
Lectures, seminars and discussions on current literature on experimental approaches, concepts and findings in population and community ecology. Course content will complement that of 61.559W1 (BIO8307); the two courses need not be taken in a particular order. Offered jointly by the staff of Carleton University and the University of Ottawa. Before 1994-95 course 61.558 (BIO8306) was offered as 61.548 (BIO9200).

- Biology 61.559W1 (BIO8307)
Advanced Population and Community Ecology II
Lectures, seminars and discussions on current literature on experimental approaches, concepts and findings in population and community ecology. Course content will complement that of 61.558F1 (BIO8306); the two courses need not be taken in a particular order. Offered jointly by the staff of Carleton University and the University of Ottawa. Before 1994-95 course 61.559 (BIO8307) was offered as 61.548 (BIO9200).

- Biology 61.560T2 (BIO5160)
Advanced Topics in Insect Evolution
The course will explore major concepts and questions in insect evolution in the areas of systematics, morphology, the fossil record, biology and behaviour. Lectures or discussions will be two hours per week and labs to be arranged.
S.B. Peck.

- Biology 61.565F1, W1, S1 (BIO5102)
Field Course
Credit for this half course is based on a total of three weeks of field-course modules, involving one or two weeks of intensive and continuous field work with attendant assignments. For details, see coordinator.
Coordinator: P.J. Weatherhead.

- Biology 61.570T2 (BIO5209)

Evolution and Biogeography

A lecture course in biogeography and evolution requiring a graduate level literature project.

Prerequisites: Graduate standing and permission of the Department.

H.F. Howden.

- Biology 61.581F1 (BIO5105)

Animal Behaviour

A half-credit course in animal behaviour from an ecological and evolutionary point of view with additional independent assignments.

Prerequisites: Biology 61.335 and 61.361 or equivalents and registration in a graduate program, or written permission of the Department.

P.J. Weatherhead.

- Biology 61.582F1 (BIO8365)

Advanced Studies in Behavioural Ecology

Recent ideas and research on advanced topics dealing with the evolution of foraging, temporal, spatial, and reproductive strategies will be discussed and critically examined. Each student will be required to give two seminars, write two term papers on selected topics, and all students will participate in discussions of controversial problems.

Offered in alternate years.

Jaroslav Picman.

- Biology 61.599F, W, S

M.Sc. Thesis

- Biology 61.601F1 (BIO8109)

Advanced Molecular Biology I

Recent advances in molecular biology. Topics for discussion may include the following: DNA structure and function, the organization of the genome; DNA, RNA and protein synthesis; the regulation of gene expression in eucaryotes and procaryotes. Topics will reflect the interests of the teaching staff. Biology 61.602W1 (BIO8217) and this course normally will be offered together in the same year but only in alternate years. Not all topics will be covered each year.

- Biology 61.602W1 (BIO8116)

Advanced Molecular Biology II

Recent advances in molecular biology. Topics for discussion may include the following: metagenesis and DNA repair mechanism; molecular aspects of gene transfer recombination and gene arrangement; gene transfer mechanisms, the molecular biology of yeasts and fungi, especially with regard to industrial applications; the modern techniques of genetic engineering as applied to industrial and medical problems. Topics will reflect the interests of the teaching staff. Biology 61.601F1 (BIO8209) and this course normally will be offered together in the

same year but only in alternate years. Not all topics will be covered each year.

- Biology 61.621F1 (BIO8117)

Advanced Cell Biology I

Recent advances in cell biology. Topics for discussion may include the following: the composition, biosynthesis and three-dimensional organization of the cytoskeleton, factors regulating its deployment and the role of cytoskeletal elements in mitosis, cell-substrate attachment, cell motility, transport of organelles and axoplasmic transport, cell surface and extracellular matrix. Topics will reflect the interests of the teaching staff. Biology 61.622W1 (BIO8118) and this course normally will be offered together in the same year but only in alternate years. Not all topics will be covered each year.

- Biology 61.622W1 (BIO8118)

Advanced Cell Biology II

Topics for discussion may include the following: the structure, composition and three-dimensional organization of the nucleus, mechanisms and regulation of genome replication, structure organization of transcription. Role of the nucleus in virus replication and hormone response, structural and functional reorganization of nuclear components during gamete development, fertilization and the mitotic cell cycle. Topics will reflect the interests of the teaching staff. Biology 61.621F1 (BIO8117) and this course normally will be offered together in the same year but only in alternate years. Not all topics will be covered each year.

- Biology 61.623F1 (ANA7400 Fall Term)

Neuroscience Techniques I

Completion of a research project carried out under the supervision of a neuroscience faculty member from a department other than the student's enroling department.

(Also offered as Psychology 49.624)

- Biology 61.624W1 (ANA7400 Winter Term)

Neuroscience Techniques II

Completion of a research project carried out under the supervision of a neuroscience faculty member from a department other than the student's enroling department. The supervisor must be different from that of 61.623.

(Also offered as Psychology 49.625)

- Biology 61.625T2 (BIO8119)

Advanced Plant Physiology

A lecture and seminar course dealing with selected topics in advanced plant physiology, available only to graduate students.

Prerequisite: Biology 61.429 or equivalent, or permission of the Department.

- Biology 61.627F1 (BIO8164)

Ion Channels

A lecture and seminar course on the physiological and biophysical characteristics of ion channels. Topics will be selected from such areas as: determinants of channels selectivity, conformation changes, chemically-induced and voltage-induced gating, models of excitability, methods of studying channels (single channel studies, gating currents, pharmacological tools), and cellular distribution, modulation and development of channels. Offered in alternate years.

- Biology 61.630T2 (BIO8220)

Advanced Plant Biochemistry

A lecture and seminar course, available only to graduate students, dealing with selected topics in advanced plant biochemistry.
Prerequisites: Biology 61.425 and Biology 61.426/427, or permission of the Department.

- Biology 61.631W1 (BIO8121)

Advanced Microbial Physiology

Physiological function of micro-organisms in relation to microscopic and molecular structure; differentiation and regulation; mode of action of antibiotics and toxic substances. Lectures and advanced reading.

- Biology 61.633T2

Advanced Seminar in Neuroscience

An advanced seminar course integrating various aspects of neuroscience.
Prerequisite: Psychology 49.520 or 49.623
(Also offered as Psychology 49.620)

- Biology 61.634F1 (BIO8361)

Advanced Topics in Animal Physiology

In-depth study of areas in animal physiology of current research interest.
J.C. Fenwick, S.F. Perry and T.W. Moon.

- Biology 61.638F1 (BIO8363)

Evolution and Adaptation in Fish

Consideration of evolution and adaptation with emphasis on concepts and ideas. Evolution of certain organ systems and phylogenetic groups. Adaptations to specific habitats. Lectures and seminars.

- Biology 61.641F1 (BIO8935)

Recent Advances in Plant Biology

Special topics of current interest.

- Biology 61.642F1 (BIO9101)

Principles of Toxicology

The basic theorems of toxicology with examples of current research problems. The concepts of expo-sure, hazard and risk assessment will be defined and illustrated with experimental material from some of the more dynamic areas of modern research.
(Also offered as Chemistry 65.578 and Psychology 49.525)

- Biology 61.643F1 (BIO9104)

Ecotoxicology

Selected topics and advances in ecotoxicology with emphasis on the biological effects of contaminants. The potential for biotic perturbance resulting from chronic and acute exposure of ecosystems to selected toxicants will be covered, along with methods of pesticide, herbicide and pollutant residue analysis and the concept of bound residues.
Prerequisite: Biology 61.642 (BIO9101)

- Biology 61.644F1 (BIO8436)

Plant: Animal Interactions

Secondary metabolites of plants and their role as attractants or antifeedants to animals and as allelopathic or antifungal agents. Emphasis will be placed on co-evolution of plants and phytophagous organisms such as insects and mammals, and the ecological and physiological dimensions of this relationship. Offered in alternate years.
J.T. Arnason, B.J.R. Philogène, Constance Nozzolillo, J.G. Houseman.

- Biology 61.645W1 (BIO9105)

Seminar in Toxicology

A course in seminar format, highlighting current topics in toxicology. The course will feature student, faculty and invited seminar speakers.
(Also offered as Chemistry 65.585 and Psychology 49.526)

- Biology 61.655W1 (BIO8108)

Advanced Topics in Development

Recent advances in developmental biology. Topics may include embryonic induction, regulation of morphogenesis and differentiation, mechanisms of regional specification and pattern formation, and developmental genetics. Offered in alternate years.
J.B. Armstrong and W.R. Bates.

- Biology 61.660T2 (BIO8242)

Special Ichthyology I

Morphology, systematics and life histories of cyclostomes, elasmobranchii and the soft-rayed telosts.

- Biology 61.680T2 (BIO8221)

Advanced Studies in Animal Behaviour

A seminar and laboratory course dealing with current topics in the study of animal behaviour. Students will be expected to present seminars based on the

recent literature, and to conduct a research project on some aspect of animal behaviour.
Prerequisites: Biology 61.581 or equivalent, or permission of the Department.
P.J. Weatherhead.

• Biology 61.699F, W, S
Ph.D. Thesis

Ottawa-Carleton Collaborative Program in Chemical and Environmental Toxicology

Tory Building 587
Telephone:788-3888
Fax: 788-4497

The Program

Coordinator of the Collaborative Program:
R.C. Wyndham

Toxicology is the study of the effects of poisons on living systems. These poisons can be either inorganic, synthetic or natural organic materials. As a field of research it cuts across traditional disciplinary boundaries such as chemistry, biology and psychology. While individual researchers usually specialize in a particular area, toxicologists today must be able to appreciate significant research in other fields and therefore require an understanding of the basic principles of other disciplines. To meet this challenge Carleton University and the University of Ottawa offer a multidisciplinary collaborative program in toxicology leading to the degree of the Master of Science.

The collaborative program is intended to augment the research and training which the student receives through one of the Institutes or departments which participates in the program.

The primary or degree-granting participating departments or institutes are:

- The Ottawa-Carleton Institute of Biology, which consists of the Departments of Biology at Carleton University and the University of Ottawa
- The Ottawa-Carleton Chemistry Institute, which consists of the Departments of Chemistry at Carleton University and the University of Ottawa
- The Department of Psychology, Carleton University

The collaborative program is coordinated by a committee of representatives of these participating units.

Applications should be directed to the primary participating unit which is most appropriate to the student's research interests. Once accepted into the Institute or department, students must be sponsored into the collaborative program in chemical and environmental toxicology by a faculty member involved in the program. This will normally be the student's supervisor. The student is responsible for fulfilling the requirements for the master's degree of the department and the institute and the additional requirements of the collaborative program.

Application forms and further information may be obtained by writing directly to any of the three participating institutes or departments.

Members of the Collaborative Program in Chemical and Environmental Toxicology

J.T. Arnason, *Toxicology of Natural Products*
C.S. Findlay, *Modelling of Toxicant Transport*
P.A. Fried, *Pharmacotoxicology*
D.R. Gardner, *Pesticide/Nerve Interactions*
B.R. Hollebone, *Chemical Toxicology*
I.B. Lambert, *Molecular Biology of Mutagenesis*
J.D. Lambert, *Plant Communities and Man*
T.W. Moon, *Comparative Physiology*
B.A. Pappas, *Developmental Psychopharmacology*
B.J. Philogène, *Ecophysiology of Insects*
Frances Pick, *Microbial Physiology and Ecology*
D.C.S. Roberts, *Drug Abuse, Brain Metabolism*
V.L.Seligy,* *Genotoxicity and Molecular Genetics*
B.W. Tansley, *Neurotoxicology*
D.C. Wigfield, *Chemical Toxicology*
R.C. Wyndham, *Molecular Microbial Ecology*
P.J. Weatherhead, *Ecology and Environmental Toxicology*

Sessional Lecturers and Associates
R.P. Moody, (Health and Welfare Canada), *Environmental Toxicology*
R. Norstrom,* (Canadian Wildlife Service), *Wildlife Toxicology*

Master's Program

Admission Requirements
The requirements for admission to the master's program in chemical and environmental toxicology are as follows:

- Prior admission to the master's program of the primary institute or department which participates in the collaborative program
- A letter of recommendation from a participating faculty member of the collaborative program, which both recommends admission and indicates the willingness of the faculty member to supervise the candidate's research program in chemical and/or environmental toxicology

Students must normally have obtained a high honours grade point average in their undergraduate

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* Adjunct Professor, Adjunct Research Professor

and/or graduate course work in order to be recommended for admission to the collaborative program.

Program Requirements

Students must fulfil the requirements for the primary academic unit in which they are enrolled (biology, chemistry or psychology). The requirements for the collaborative program in chemical and environmental toxicology include:

- Principles of Toxicology
- Seminar in Toxicology
- One additional half-credit course in toxicology
- A research thesis on a topic in toxicology supervised by a faculty member of the collaborative program in chemical and environmental toxicology

Graduate Courses*

Students are advised to check in July of each year with the department concerned for the scheduling of these courses.

Other courses listed in the calendar under the primary academic units of psychology, biology or chemistry may be taken, with the approval of the student's supervisory committee, as options in addition to the basic requirements of the degree in chemical and environmental toxicology.

- Biology 61.642F1 (BIO9101)
Principles of Toxicology
The basic theorems of toxicology with examples of current research problems. The concepts of exposure, hazard and risk assessment will be defined and illustrated with experimental material from some of the more dynamic areas of current research.
(Also offered as Chemistry 65.578/CHM8156 and Psychology 49.525)

- Biology 61.643F1 (BIO9104)
Ecotoxicology
Selected topics and advances in ecotoxicology with emphasis on the biological effects of contaminants. The potential for biotic perturbance resulting from chronic and acute exposure of ecosystems to selected toxicants will be covered, along with methods of pesticide, herbicide and pollutant residue analysis and the concept of bound residues.
Prerequisite: Biology 61.642(BIO9101)

- Biology 61.645W1 (BIO9105)
Seminar in Toxicology
A course in seminar format highlighting current topics in toxicology. The course will feature student, faculty and invited seminar speakers.
(Also offered as Chemistry 65.585/CHM8167 and Psychology 49.526)

- Chemistry 65.579 (CHM8157)
Chemical Toxicology
An advanced course in chemical toxicology which deals with both chemical hazard and exposure. An overview of the empirical data relating to the toxicity of various classes of chemicals to test organisms is followed by a treatment of toxicity at the cellular level, including studies of interaction between toxic substances and enzymatic systems. This is the type of data which a student could apply to the interpretation and monitoring of the new WHMIS health regulations. Initial events in enzyme induction and mutagenesis are considered. Predictive capacities in the areas of structure-activity relationships and mechanisms of enzyme induction are considered, followed by an assessment of mechanism of exposure of toxic chemicals.

- Psychology 49.524F1, W1
Principles and Methods in Behavioural Toxicology
A half-credit course examining the basic concepts of behavioural toxicology starting with a general discussion of behaviour testing methodology and then focusing on procedures used in screening chemicals for behavioural effects, and more advanced tests. Controversial examples from current research are used to illustrate the practical problems of assessing both animal and human behavioural toxicity.

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* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

The Ottawa-Carleton Chemistry Institute

Steacie Building 218
Telephone: 788-3841
Fax: 788-3749

UNIVERSITÉ D'OTTAWA
UNIVERSITY OF OTTAWA

CARLETON UNIVERSITY

The Institute

Director of the Institute:
G.W. Buchanan
Associate Director of the Institute:
René Roy

The Ottawa-Carleton Chemistry Institute, established in 1981, is a joint program of graduate studies and research in chemistry for Carleton University and the University of Ottawa. The Institute combines the research strengths and resources of the Departments of Chemistry at both campuses. Research facilities are shared and include: a major mass spectrometry centre, X-ray spectrometer, several modern NMR spectrometers, a pico-second laser facility, an ultratrace analysis laboratory, and an electrochemical research centre. In addition, the resources of many federal departments are available to graduate students, including the National Research Council and its library, the National Science Library (CISTI), and departments of Health and Welfare and Agriculture.

The Institute offers the M.Sc. and Ph.D. degrees in all areas of chemistry, including biochemistry, analytical, inorganic, organic, physical and theoretical chemistry. All thesis, seminar and examination requirements may be met in either English or French. Students will be enrolled at the campus where the research supervisor is located. Several graduate students also conduct their research off campus under the supervision of one of the Institute's adjunct professors.

Application forms and further information may be obtained by writing to the director of the Institute.

Ottawa-Carleton Collaborative Program in Chemical and Environmental Toxicology

The Departments of Chemistry and Biology at Carleton University and the University of Ottawa, and the Department of Psychology at Carleton University, provide a collaborative program in chemical and environmental toxicology at the M.Sc. level. For further details, see page 173.

Members of the Institute

Howard Alper, *Organometallic Chemistry*
J.W. ApSimon, *Natural Products Chemistry*
M.H. Back, *Chemical Kinetics and Photochemistry*
R.G. Barradas, *Electrochemistry*
A.D.O. Bawagan, *Chemical Physics*
D.M. Bishop, *Theoretical Chemistry*
G.W. Buchanan, *Applications of NMR Spectroscopy*
P.H. Buist, *Bio-organic Chemistry*
C.L. Chakrabarti, *Analytical Chemistry, Environmental Chemistry*
B.E. Conway, *Electrochemistry*
R.J. Crutchley, *Physical Inorganic Chemistry*
Christian Detellier, *Bio-inorganic Chemistry*
Tony Durst, *Synthetic and Medicinal Organic Chemistry*
A.G. Fallis, *Synthetic Organic Chemistry*
R.R. Fraser, *Physical Organic Chemistry*
Sandro Gambarotta, *Inorganic Chemistry*
B.R. Hollebone, *Chemical Spectroscopy and Chemical Toxicology*
J.L. Holmes, *Mass Spectroscopy*
K.U. Ingold,* *Physical Organic Chemistry, Free Radicals*
Harvey Kaplan, *Biochemistry*
J.A. Koningstein, *Chemical Physics*
Peeter Kruus, *Solution Physical Chemistry, Ultrasonics*
E.P.C. Lai, *Photoacoustic Spectroscopy, Analytical Chemistry*
K.J. Laidler, *Reaction Kinetics*, Professor Emeritus
J.B. Milne, *Chemistry of Non-Metals*
Mario Morin, *Interfacial Chemistry*
B.A. Morrow, *Surface Chemistry and Catalysis*
D.S. Richeson, *Inorganic, Solid State and Organometallic Chemistry*
J.A. Ripmeester,* *Colloid and Clathrate Chemistry*
René Roy, *Organic Chemistry*
J.C. Scaiano, *Photochemistry*
A.St.-Amant, *Theoretical and Computational Chemistry*
K.B. Storey, *Enzyme Biochemistry, Biotechnology*
Heshel Teitelbaum, *Chemical Kinetics*
C.S. Tsai, *Enzyme Action and Yeast Cultures*
Z.Y. Wang, *Synthetic Polymer Chemistry and Organic Chemistry*
D.C. Wigfield, *Organic Reaction Mechanisms, Mechanisms in Toxicology*
C.P. Wilde, *Electrochemistry*
J.S. Wright, *Theoretical Chemistry*

* Adjunct Professor, Adjunct Research Professor

Master of Science

Admission Requirements
The normal requirement for admission to the program is an honours B.Sc. degree in Chemistry, with a B+ average in the last two years and a B average overall. Applicants who do not meet this requirement, or whose undergraduate degree is in another, closely related field, may be accepted into the program, but may be assigned extra courses.

Program Requirements
- A research thesis, which must be defended at an oral examination
- Two graduate courses (one semester each)
- One seminar course (two semesters)

Doctor of Philosophy

Admission Requirements
The normal requirement for admission to the Ph.D. program is a B.Sc. or an M.Sc. degree in Chemistry.

Program Requirements (from B.Sc.)
- A research thesis, to be defended before an examination board which will include an external examiner
- A comprehensive examination in chemistry; the format of this examination depends on the field of chemistry in which the student is conducting his/her research. At Carleton this normally takes the form of a research proposal
- Four graduate courses (one semester each)
- Two seminar courses (two semesters each)

Program Requirements (from M.Sc.)
As above, except that credit for up to two graduate courses may be given to reduce the requirement for graduate courses from four to two.

Residence Requirements
For the M.Sc. degree:
- at least one year of full-time study

For the Ph.D. degree (from B.Sc.):
- at least three years of full-time study

For the Ph.D. degree (from M.Sc.):
- at least two years of full-time study

Graduate Courses*

- Chemistry 65.509 (CHM8150)
Special Topics in Molecular Spectroscopy
Topics of current interest in molecular spectroscopy. In past years, the following areas have been covered: electronic spectra of diatomic and triatomic molecules and their interpretation using molecular orbital diagrams; Raman and resonance Raman spectroscopy; symmetry aspects of vibrational and electronic levels of ions and molecules in solids the presence of weak and strong resonant laser radiation.
(Also offered as Physics 75.522/PHY8122)

- Chemistry 65.511(CHM8181)
Chemical Physics of Electron-Molecule Collisions
Basic classical scattering theory and quantum mechanical scattering theory. Experimental aspects, such as electron optics, electron gun fundamentals, energy analyzers and electron detectors. Applications to the understanding of the chemistry of materials.

- Chemistry 65.516 (CHM8170)
Quantum Chemistry
Molecular orbital theory and its application to chemistry. Self-consistent field method, results for diatomic molecules. Configuration interaction and molecular dissociation. Basis sets and molecular properties. *Ab initio* versus semi-empirical approaches. Correlation diagrams for chemical reactions. Polyatomic molecules and potential energy surfaces.

- Chemistry 65.517 (CHM8161)
Physical Chemistry of Solutions
Major theoretical approaches and experimental methods used in the study of liquids and solutions. *Prerequisite:* A reasonable background knowledge in thermodynamics, quantum chemistry and statistical mechanics.

- Chemistry 65.520 (CHM8152)
Surface Chemistry and Catalysis
Adsorption phenomena and isotherms, surface area of solids. Modern techniques in surface chemistry and surface science such as electron diffraction, Auger electron spectroscopy, photo-electron spectroscopy, electron energy loss spectroscopy, infrared and Raman spectroscopy. Current new techniques.

- Chemistry 65.522 (CHM8131)
Physical Chemistry of Electrolytic Solutions
Properties of water, hydration of ions, ionic interaction, colloidal and polymeric electrolytes. Ionization processes in solution.

- Chemistry 65.523 (CHM8141)
Applied Electrochemistry
Selected topics in applied electrochemistry will be reviewed including metal electrodeposition, organic electrochemistry, performance of batteries, electrochemical energy conversion, corrosion and passivity. Electrochemistry at semiconductors.

- Chemistry 65.524 (CHM8151)
Electrochemistry at Interfaces
Introduction to electrode processes and electrolysis. Potential differences at interfaces. Characterization of the electrical double layer. Dipole orientation effects; charge transfer in absorbed layers; electrochemical origins of surface science concepts. Theory of electro transfer; electrode kinetics; electrocatalysis. Industrial applications; photo-electrochemistry.

- Chemistry 65.527 (CHM8121)
Organic Reaction Mechanisms
Advanced physical organic chemistry, including topics such as: acidity functions, pK_a's of organic compounds, steric and electronic effects in organic chemistry, molecular orbital theory and correlation diagrams, structure calculations using molecular mechanics.

- Chemistry 65.528 (CHM8133)
Multinuclear Magnetic Resonance Spectroscopy
Principles of Nuclear Magnetic Resonance (NMR). The NMR parameters to be studied are: chemical shift, spin-spin coupling, electric quadrupole coupling, spin-spin and spin-lattice relaxation rates. NMR and the periodic table. Dynamic NMR. Applications in chemistry and biochemistry. The Fourier Transform technique. Pulse sequences. Basic principles and applications of two-dimensional NMR.

- Chemistry 65.529 (CHM8154)
Reaction Intermediates
Introduction to the basic principles of photo-chemistry in condensed phases as a method for the generation of reactive intermediates. This is followed by a series of selected topics to cover various types of reaction intermediates and the techniques for their study. Topics include: excited states, free radicals, carbenes, biradicals, enols, carbocations and zwitterionic intermediates. The techniques include laser and conventional flash photolysis, pulse radiolysis, esr, CIDNP and matrix isolation. Several of these topics are covered in student seminars.

- Chemistry 65.530 (CHM8159)
Total Synthesis: Strategies and Case Studies
General procedures for the total synthesis of natural products will be examined. A general discussion of retrosynthetic planning, choice of starting materials, multiple bond construction, stereochemical considerations and choice of strategies will be followed by the analysis of recent syntheses. Comparison of alternative solutions emanating from different laboratories will be studied as will recent trends including pericyclic reactions, free radical cyclizations, etc. A reasonable knowledge of modern organic reactions is assumed.

- Chemistry 65.531 (CHM8160)
Chiron Approach to Natural Product Syntheses
Retrosynthetic analysis and description of natural product total synthesis through the chiron strategy with emphasis on carbohydrates and amino acids as chiral building blocks. Macrolides and polyether synthesis. Diversity in carbohydrates; chiral templates and their selective manipulations. Aspects of protecting group chemistry, stereoelectronic effects, and chirality induction and transfer.

- Chemistry 65.532 (CHM8132)
Enzymology and Protein Chemistry
Basic principles of structure-function relationships in proteins. Chemical nature of polypeptides and the folded conformation of proteins. Enzymatic catalysis; protein engineering.

- Chemistry 65.533 (CHM8126)
Bioorganic Chemistry
Overview of recent developments in the general area of biocatalysis. Current examples of the biotransformation of organic compounds using enzyme models, abzymes, enzymes, immobilized enzymes, microbial cells and recombinant microbial cells. Biosynthetic procedures of industrial importance in waste management.

- Chemistry 65.538 (CHM8122)
Solid State Chemistry
Thermodynamic and kinetic aspects of solid state synthesis.Spectroscopic and structural characterization of solids. Chemical and physical properties of solids including intercalation reactions, ionic conductors, glasses, electronic, magnetic, optical, and physical/mechanical properties.
Before 1994-95 course 65.538 (CHM8122) was offered as 65.545 (CHM8127).

- Chemistry 65.539 (CHM8144)
Electron Transfer Reactions: Theory and Experiment
Development of electron transfer theory from classical, semi-classical to quantum mechanical treatments. Recent experimental results related to classical

Marcus electron transfer theory and the application of electron transfer theory to biological processes.

● Chemistry 65.540 (CHM8114)
Special Topics in Non-Metal Chemistry
Topics of current interest in non-metal chemistry. The content of this course may vary from year to year.

● Chemistry 65.541 (CHM8117)
Organometallic Chemistry
A discussion of the formation, character, bonding and reactions of compounds containing organic ligands bound to metals through from one to eight carbon atoms. Industrial processes (olefin meta-thesis, the OXO process, the Monsanto acetic process, etc.) and biological processes (e.g. reactions catalyzed by coenzyme B_{12}) are also examined. The emphasis is on transition metal chemistry, including synthesis and mechanisms of the reactions concerned, and on the physical techniques available for characterization of the compounds.

● Chemistry 65.542 (CHM8115)
Special Topics in Inorganic Chemistry
Topics of current interest in inorganic chemistry. In the past, the course has covered Ceramics: binary and ternary phase diagrams and their thermodynamic basis; pyrometallurgical and ceramic thermochemistry; glasses; molten salts and solid solutions; defects; doping and preparation of pure materials; electrical and surface properties of ceramics.

● Chemistry 65.543 (CHM8112)
Methods in Analytical Chemistry
The critical evaluation and selection of analytical techniques. Areas to be covered include: analytical aspects of atomic spectroscopy, electro-chemistry, chromatography, molecular spectrometry, mass spectrometry. This course provides a sound basis for choosing the best analytical technique for a particular problem. The focus will be on: when a technique is applicable; limitations, advantages and disadvantages; detection limits, sensitivity and interference; commercially available instrumentation.

● Chemistry 65.544 (CHM8125)
Organic Synthesis (Carbanion Chemistry)
Discussion of recent developments in the use of carbanion chemistry for the making of carbon-carbon and carbon-heteroatom bonds. Particular emphasis is given to methods which yield optically active products. In the most recent course the following topics were covered: methods of generating carbanions, kinetic versus thermo-dynamic acidity, heteroatom-stabilized carbanions, the aldol and related condensations, Michael addition reactions, and ortho-metalation in aromatic systems.

● Chemistry 65.546 (CHM8164)
Organic Polymer Chemistry
Introduction to basic principles of polymer chemistry, industrial and synthetic polymers, different types of polymerization and polymer characterization. This is followed by a series of selected topics to cover some important polymers with emphasis on the synthesis, such as commodity plastics, engineering thermoplastics and specialty polymers.
Prerequisites: Chemistry 65.321 and 65.322 and/or 65.423 or equivalent. Students should have a basic knowledge of organic reaction mechanisms and stereochemistry.
Also offered at the undergraduate level, with different requirements, as 65.424, for which additional credit is precluded.

● Chemistry 65.547 (CHM8134)
Spectroscopy for Organic Chemists
Analysis of proton NMR spectra. Fourier transform ^{13}C NMR, strategies for structure elucidation relaxation times, two-dimensional NMR. Aspects of mass spectrometry.
Also offered at the undergraduate level, with different requirements, as 65.442, for which additional credit is precluded.

● Chemistry 65.548 (CHM8122)
Special Topics in Organic Chemistry
Topics of current interest in organic chemistry. In the past one course has covered solid state NMR: chemical aspects of solid state structure; molecular ordering and motion in the solid state; magnetic interactions; hydrogen, deuterium and ^{13}C NMR; experimental methods; applications; relationship between high resolution solid-state and solution NMR.

● Chemistry 65.549 (CHM8123)
Recent Advances in Organic Chemistry
Topics of current interest will be discussed.

● Chemistry 65.550 (CHM8116)
Analytical Instrumentation
Principles of modern electronic instrumentation and their application in the chemical laboratory. Scientific instruments; measurement and control systems; microcomputer interfacing. Instrumentation concepts including feedback control, signal-to-noise enhancement, data acquisition, and signal processing will be presented along with the techniques and devices for their implementation. A parallel laboratory is taught using modern test instruments. Examples include absorption spectrophotometer, derivative titration thermocouple, pH meter, and cyclic voltammetry.

• Chemistry 65.551 (CHM8220)
Problems in Organic Chemistry
The problems which are assigned in this course are of two types: (1) written examinations on a particular topic in organic chemistry, (2) critical reviews of papers in the current organic literature, i.e. a simulated referee's report on the paper. In order to pass the course, eight "problems" must be solved satisfactorily.

• Chemistry 65.552 (CHM8110)
Analytical Approach to Chemical Problems
Case-study approach to a variety of problems in agricultural, biochemical, environmental, food processing, geological, industrial and surface sciences that can be solved by analytical chemistry. Comparative study of analytical methods appropriate to each case includes: capillary electrophoresis, chemiluminescence, electrochemical biosensors, Fourier transform infrared spectroscopy, inductively coupled plasma emission, neutron activation analysis, sensor arrays, secondary ion mass spectrometry, tandem mass spectrometry, and ultra-high resolution nuclear magnetic resonance spectroscopy. Modern data analysis techniques such as pattern recognition are also discussed.

• Chemistry 65.553 (CHM8108)
Analytical Mass Spectrometry
The course consists of four sections. 1) The basics of mass spectrometry and gas phase ion chemistry. 2) The instrumentation currently available and the principles of its operation. Methods of ionization. 3) Separation techniques, their successes and limitations when connected to a mass spectrometer. 4) The obtaining and interpretation of data. The relationships between mass spectra and chemical structure.

• Chemistry 65.555 (CHM8119)
Advanced Ultratrace Analytical Chemistry
Criteria for evaluation and selection of analytical techniques and methods. Simultaneous and sequential multielement analysis. Atomic absorption, atomic emission and atomic fluorescence spectrometry, using optical spectrometric and mass-spectrometric determination. Electroanalytical techniques. Applications of these techniques at trace and ultratrace levels in complex matrices.

• Chemistry 65.557 (CHM8162)
Environmental Organic Chemistry
Methods for determination of organic analytes in environmental systems. All aspects of a method will be discussed, including sampling, sample treatment, measurement, quality control, and data significance. Application to such environmentally important analytes as PCG's, dioxins, pesticides, herbicides, trihalomethanes, and polycyclic aromatic hydrocarbons. Rationale and selection of specific methods.

• Chemistry 65.558 (CHM8163)
Special Topics in Analytical Chemistry
Topics of current interest in analytical chemistry. The content of this course may change from year to year.

• Chemistry 65.570 (CHM8143)
Special Topics in Physical Chemistry
Topics of current interest in physical chemistry. The content of this course may change from year to year.

• Chemistry 65.571 (CHM8145)
Photochemistry
Photochemical reactions of small molecules and the relation to atmospheric chemistry. Lasers and applications to measurements of the dynamics of elementary reactions. Production and detection of reactive species. Energy transfer processes. Photolysis of formaldehyde and carbonyl compounds. Multiphoton absorption of infrared radiation.

• Chemistry 65.572 (CHM8135)
Theories of Chemical Reaction Rates
Concepts and theories of chemical kinetics. Significance of activation energy; transition state theory and more modern developments; reaction dynamics. Other optional topics include unimolecular gas reactions, theory of solvent effects, homogeneous and heterogeneous catalysis, and kinetic isotope effects.

• Chemistry 65.573 (CHM8137)
Advanced Chemical Kinetics
Study of the principles involving the exchange of translational, rotational, vibrational and electronic energy in molecular collisions. Influence of energy transfer processes on thermal unimolecular and biomolecular reactions. Study of the relationship between microscopic and macroscopic kinetics of elementary reactions.

• Chemistry 65.574 (CHM8142)
Symmetry in Chemistry
Introduction to group theory with emphasis upon irreducible representations. Application to molecular vibrations, molecular orbital theory and transition metal chemistry.

• Chemistry 65.576 (CHM8148)
Gas Phase Ion Chemistry
Structure, energetics and reaction kinetics of ions in the gas phase. Small organic ions, chemistry of free radicals, hypervalent species. Contemporary experimental methods in the physical chemistry of fast ion beams. Emphasis will also be upon recent work on novel ions and neutral species of relevance to interstellar chemistry.

- Chemistry 65.577 (CHM8138)
Enzyme Kinetics and Mechanism
Kinetic studies of enzymic reactions. Enzyme efficiency, specificity and versatility. Mechanisms and regulation of enzymic reactions. Analyses of enzymic systems.

- Chemistry 65.578 (CHM8156)
Principles of Toxicology
The basic theorems of toxicology with examples of current research problems. The concepts of exposure, hazard and risk assessment will be defined and illustrated with experimental material from some of the more dynamic areas of modern research.
(Also offered as Biology 61.642 and Psychology 49.525)

- Chemistry 65.579 (CHM8157)
Chemical Toxicology
An advanced course in chemical toxicology which deals with both chemical hazard and exposure. An overview of the empirical data relating to the toxicity of various classes of chemicals to test organisms is followed by a treatment of toxicity at the cellular level, including studies of interaction between toxic substances and enzymatic systems. This is the type of data which a student could apply to the interpretation and monitoring of the new WHMIS health regulations. Initial events in enzyme induction and mutagenesis are considered. Predictive capabilities in the areas of structure-activity relationships and mechanisms of enzyme induction are considered, followed by an assessment of mechanism of exposure of toxic chemicals.

- Chemistry 65.581 (CHM8256S)
Seminar I

- Chemistry 65.582 (CHM8257S)
Seminar II

- Chemistry 65.585 (CHM8167)
Seminar in Toxicology
A course in seminar format, highlighting current topics in toxicology. The course will feature student, faculty and invited seminar speakers.
(Also offered as Biology 61.645 and Psychology 49.526)

- Chemistry 65.590 (CHM8158)
Directed Special Studies
Under unusual circumstances and with the recommendation of the research supervisor, it is possible to engage in directed study on a topic of particular value to the student. This may also be used for credit if there are insufficient course offerings in a particular field of chemistry.

- Chemistry 65.599 (CHM7999)
M.Sc. Thesis

- Chemistry 65.699 (CHM9999)
Ph.D. Thesis

Ottawa-Carleton Institute for Computer Science

Herzberg Building 538
Telephone: 788-4333
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UNIVERSITÉ D'OTTAWA
UNIVERSITY OF OTTAWA

CARLETON UNIVERSITY

The Institute

Director of the Institute:
S.P. Dandamudi
Associate Director of the Institute:
S.J. Matwin

Students who wish to pursue studies in computer science leading to an M.C.S. or a Ph.D. degree can do so in a joint program offered by the Department of Computer Science at the University of Ottawa and the School of Computer Science at Carleton University under the auspices of the Ottawa-Carleton Institute for Computer Science. The Institute is responsible for supervising the program and for providing a framework for interaction between the two departments at the research level. In addition to the faculty members from the two computer science departments the Institute also has members with computer science expertise from other departments.

   Requests for information, and completed applications, should be sent to the director or associate director of the Institute. A joint admissions committee examines all applications and assigns students to the most appropriate campus and supervisor.

Members of the Institute
The "home" department of each member is indicated by (CSI) for the Department of Computer Science, University of Ottawa, (ELG) for the Department of Electrical Engineering, University of Ottawa, (ADM) for Faculty of Administration, University of Ottawa, (MCG) for the Department of Mechanical Engineering, University of Ottawa, (SCS) for the School of Computer Science, Carleton University, (MAT) for the Department of Mathematics and Statistics, Carleton University, (SCE) for the Department of Systems and Computer Engineering, Carleton University, (C) for the Department of Civil Engineering, Carleton University, (BUS) for the School of Business, Carleton University.

M.D. Atkinson, (SCS), *Complexity, Algorithms, Computational Algebra*
L.G. Birta, (CSI), *Simulation, Optimization, Numerical Algorithms*
Sylvia Boyd, (CSI), *Optimization, Combinatorics*

R.J. Buhr, (SCE), *Software Design, Design Visualization, Real-Time and Distributed Systems, Object-Oriented Systems*
T.-Y. Cheung, (CSI), *Distributed Computing, Optimization, Databases*
J.W. Chinneck, (SCE), *Operations Research, Applied Optimization*
J.-P. Corriveau, (SCS), *Cognitive Science, Natural Language Understanding, CASE Tools*
S.P. Dandamudi, (SCS), *Parallel and Distributed Systems, Database Systems, Performance Evaluation, Computer Architecture, Operating Systems*
N.W. Dawes, (SCE), *Diagnosis and Pattern Recognition*
Frank Dehne, (SCS), *Computational Geometry, VLSI Algorithms*
J.D. Dixon, (MAT), *Algorithms, Algebra, Number Theory*
A.E.F. Fahim, (MCG), *Nonlinear Optimization, CAD/CAM Methodology and Software, FMC Control Environment, Robot Control, Expert Systems for Design and Manufacturing*
Frantisek Fiala, (SCS), *Optimization, Combinatorics*
N.D. Georganas, (ELG), *Computer Communications, Mobile Radio*
Morris Goldberg, (ELG), *Image Processing, Pattern Recognition*
R.C. Holte, (CSI), *Artificial Intelligence, Machine Learning, Knowledge Compilation*
N.M. Holtz, (C) *Computer-aided Structural Engineering*
G.M. Karam, (SCE), *Concurrent and Real-Time Systems, Software Engineering, Communications Software*
A.R. Kaye, (SCE), *Broadband Networks, BISDN, ATM, Performance Evaluation, Traffic Management and Design*
G.F. Kersten, (BUS), *Knowledge-based Systems, Intelligent Decision Support, Problem Structuring and Representation*
Evangelos Kranakis, (SCS), *Cryptography, Computational Number Theory, Combinatorial Analysis, Computational Geometry, Distributed Computing, Mathematical Logic*
Moshe Krieger, (ELG), *Computer Architecture*
Danny Krizanc, (SCS), *Parallel and Distributed Computing, Analysis of Algorithms and Use of Randomization in Computation*
W.R. LaLonde, (SCS), *Object-Oriented Systems, Design and Analysis Tools, Animation Systems*
Luigi Logrippo, (CSI), *Software Methodology, Communications Protocols*

S.A. Mahmoud, (SCE), *Wireless Communication Systems, Protocols for High Speed Networks, Speech Processing and Computer Network Design*

S.J. Matwin, (CSI), *Programing Languages, Expert Systems*

A. Mili, (CSI), *Formal Specification, Program Transformation*

L.R. Morris, (SCE), *Signal Processing, Speech Analysis, Graphics*

B.C. Mortimer, (MAT), *Combinatorics, Algorithms, Groups Theory*

J. E. Neilson, (SCS), *Distributed and Parallel Computing (including Operating Systems, Performance Models, and Applications), Simulation and Prototyping Methodology, Computer Systems Performance Engineering*

L.D. Nel, (SCS), *Network Reliability and Performance, Digital Signal Processing, Computer Music*

J.B. Oommen, (SCS), *Learning Systems, Stochastic Automata, Pattern Recognition, Image Processing, Adaptive Data Structures*

Franz Oppacher, (SCS), *Artificial Intelligence, Genetic Algorithms, Evolutionary Computing, Machine Learing*

T.I. Oren, (CSI), *Simulation, Modelling*

R.B. Osborne, (SCS), *Speculative Computation, Parallel Processing, Programing Languages*

E.J. Otoo, (SCS), *Databases, Algorithms*

Bernard Pagurek, (SCE), *Queuing, Databases*

R.L. Probert, (CSI), *Communications, Expert Systems*

J.R. Pugh, (SCS), *Object-Oriented Programing Systems, User Interfaces, Computer Graphics*

Jacques Raymond, (CSI), *Computer Architecture, Graphics*

Irwin Reichstein, (SCS), *Numerical Applications, Microcomputers*

Ivan Rival, (CSI), *Combinatorics, Optimization, Algorithms*

J.-R. Sack, (SCS), *Algorithms and Complexity, Sequential and Parallel Computing, Computational Geometry, Geographic Information Systems, Medical Computing*

Nicola Santoro, (SCS), *Distributed Computing, Fault-Tolerance, Discrete Chaos, Reactive Environments*

Philip Scott, (CSI), *Logic, Theoretical Computer Science, Category Theory*

J.B. Sidney, (ADM), *Combinatorics, Complexity, Computational Geometry*

D.R. Skuce, (CSI), *Artificial Intelligence, Logic Programing*

Ivan Stojmenovic, (CSI), *Computational Geometry, Multiple-valued Logics, Parallel Computing*

Stan Szpakowicz, (CSI), *Logic Programing, Computational Linguistics*

D.A. Thomas, (SCS), *Artificial Intelligence, Fifth Generation Machines*

Hasan Ural, (CSI), *Software Reliability and Testing, Data Communication Protocols, Applications of Logic Programing*

Jorge Urrutia, (CSI), *Algorithms, Combinatorics, Geometry And Algorithms*

Rémi Vaillancourt, (CSI), *Numerical Methods*

G.M. White, (CSI), *Networking, Office Automation*

C.M. Woodside, (SCE), *Performance Modelling, Performance of Distributed Software, Software Design, Queuing Theory*

Negib Zaguia, (CSI), *Optimization, Theory of Algorithms, Theory of Ordered Sets*

Master of Computer Science

Admission Requirements

Applicants should have an honours bachelor's degree in computer science or equivalent, with at least high honours standing. By *equivalent* is meant an honours degree in a program which includes at least twelve computer science half courses, two of which must be at the fourth-year level, as well as eight half courses in mathematics, one of which must be at the third- or fourth-year level. These courses must include the topics indicated below:

Computer Science

Data structures/file management, operating systems, computer architecture, algorithm design and analysis, assembly language and two high-level languages

Mathematics

Calculus, linear algebra, algebraic structures or discrete mathematics, probability and statistics, numerical analysis. Applicants who have a general (pass) bachelor's degree, or who otherwise lack the required undergraduate preparation, may be admitted to a qualifying-year program. Refer to the general section of this calendar for regulations governing the qualifying year.

Program Requirements

The program includes graduate study and research in four broad areas identified as follows:

• *Programing Systems and Languages*

Database systems, operating systems, software methodology, software translators, language design

• *Theory of Computing*

Analysis of algorithms, automata theory, formal languages, complexity, computability, logic and program schemata

• *Computer Applications*

Artifical intelligence, graphics, picture and signal processing, modelling and simulation, numerical analysis, optimization

• *Computer Systems*

Computer architecture, networks and distributed processing, computer communications, mini- and microcomputers

Within these areas, the program emphasizes problems of current practical significance and has close links to the scientific and industrial communities.

Normally, students in the program will be expected to complete a thesis; however, students who have substantial relevant work experience may be permitted to take the non-thesis option, which must include a graduate research project course. Each candidate submitting a thesis will be required to undertake an oral defence of the thesis.

Students in the thesis option must take five half courses or equivalent, fulfil the graduate seminar requirement, and complete a thesis. Students in the non-thesis option must take ten half courses, and fulfil the graduate seminar requirement. The course selections must be approved by the student's academic adviser, and must include at least:

• One half course in programing systems and languages
• One half course in the theory of computing
• One half course in either computer applications or computer systems

The graduate seminar requirement includes a seminar presentation and participation in at least thirteen seminars in the Joint Graduate Student Seminar Series.

Both course and thesis work may be completed either by full-time or part-time study.

A candidate may be permitted to carry out thesis work off campus provided that suitable arrangements are made for supervision and experimental work, and prior approval is given by the Institute.

Doctor of Philosophy

Admission Requirements

A Master's degree in Computer Science (or equivalent) with high second-class standing is normally required for admission into the Ph.D. program. Students who are currently registered in the M.C.S. program may, in exceptional cases, be permitted to transfer into the Ph.D. program if they have completed all course requirements with at least high second-class standing and demonstrate significant promise for advanced research.

Program Requirements

• A minimum of five half courses, or equivalent, at the graduate level which must include: one half course in programing systems and languages; one half course in the theory of computing; one

half course in either computer applications or computer systems
• Presentation of at least two seminars in the Computer Science Institute seminar series
• A comprehensive examination involving breadth and depth components
• A written thesis proposal defended at an oral examination
• A research thesis, defended at an oral examination

Residence Requirement

Students must fulfil a residence requirement of at least four terms of full-time study.

Graduate Courses

The courses in the following list are offered by various departments indicated by the prefix of the course code as follows:

Carleton University

70   Department of Mathematics and Statistics
94   Department of Systems and Computer Engineering
95   School of Computer Science

University of Ottawa

CSI   Department of Computer Science
ELG   Department of Electrical Engineering
MAT   Department of Mathematics

Programing Systems and Languages

94.480		Software Engineering
95.404		Systems Software
95.490		Advanced Topics in Computer Science
94.531	(ELG6131)	System Design with Ada
94.573	(CSI5115)	Integrated Database Systems
94.579	(CSI5112)	Advanced Topics in Software Engineering
95.501	(CSI5113)	Foundations of Programing Languages
95.502	(CSI5119)	User-Interface Facilities
95.514	(CSI5314)	Object-oriented Systems
95.516	(CSI5123)	Languages for Parallel Computing
CSI5107	(95.569)	Program Construction and Fault Tolerance
CSI5111	(95.551)	Software Testing: Theory and Practice
CSI5118	(95.578)	Design of Compilers and Translators
CSI5184	(95.584)	Logic Programing

CSI5507	(95.569)	La Construction et la Tolérance aux Fautes des Programmes
CSI5518	(95.578)	Conception des compilateurs et traducteurs
CSI5584	(95.584)	Programmation logique

Theory of Computing

70.482		Introduction to Mathematical Logic
70/95.483		Topics in Applied Logic
70/95.484		Design and Analysis of Algorithms
70/95.485		Theory of Automata
70/95.486		Numerical Linear Analysis
95.409		Introduction to Parallel and Systolic Computing
70.565	(MAT5165)	Theory of Automata
70.585	(MAT5308)	Topics of Algorithm Design
95.503	(CSI5308)	Principles of Distributed Computing
95.504	(CSI5305)	Topics in Arithmetic Complexity
95.505	(CSI5390)	Automata Models of Learning Systems
95.508	(CSI5164)	Computational Geometry
95.522	(CSI5172)	Network Reliability
95.528	(CSI5167)	Complexity of Boolean Functions
95.573	(CSI5163)	Algorithm Analysis and Design
95/70.587	(CSI5104)	Formal Language and Syntax Analysis
95.662	(CSI7170)	Advanced Topics in Distributed Computing
CSI5101	(95.561)	Formal Models of Computational Systems
CSI5107	(95.569)	Program Construction and Fault Tolerance
CSI5108	(95.570)	Software Specification and Verification
CSI5109	(95.571)	Algebraic Specification Methods for Distributed Systems
CSI5110	(95.577)	Principles of Formal Software Development
CSI5162	(95.572)	Topics in the Theory of Computing
CSI5165	(95.579)	Combinatorial Algorithms
CSI5166	(95.585)	Applications of Combinatorial Optimization

CSI5174T	(95.564)	Specification and Validation of Communication Software
CSI5507	(95.569)	La Construction et la Tolérance aux Fautes de Programmes
CSI5508	(95.570)	Spécification et Vérification de Logiciels
CSI5509	(95.571)	Méthodes Algébriques pour la Spécification de Systemes Répartis
CSI5510	(95.577)	Principes de développement formel de logiciels
CSI5565	(95.579)	Algorithmes Combinatoires

Computer Applications

70/95.486		Numerical Linear Algebra
94.405		Discrete Simulation and Its Applications
95.402		Computer Graphics
95.403		Transaction Processing Systems
95.405		First Course in Robotics and Computer Vision
95.407		Applied Artifical Intelligence
70.569	(MAT5301)	Topics in Combinatorial Mathematics
70.581	(MAT5303/ADM6385)	Linear Optimization
70.583	(MAT5304/ADM6386)	Nonlinear Optimization
70.584	(MAT5307/ADM6387)	Topics in Operations Research
70.586	(MAT5180)	Numerical Analysis
70.588	(MAT5305)	Combinatorial Optimization I
70.589	(MAT5306)	Combinatorial Optimization II
94.501	(CSI5120)	Simulation and Modelling
94.504	(ADM6371)	Mathematical Programing for Engineering Applications
94.505	(CSI5150)	Optimization Theory and Methods
94.534	(ELG6134)	Mini-Micro Applications
94.535	(ELG6135)	Representations and Methods in Design Tools for Concurrent Systems
94.542	(ELG6142)	Advanced Dynamics with Applications to Robots
94.553	(ELG6153)	Stochastic Processes

95.506	(CSI5306)	Natural Language Understanding
95/94.507	(CSI5307)	Expert Systems
95.510	(CSI5180)	Topics in Artificial Intelligence
95.513	(CSI5313)	Cryptography
95.520	(CSI5182)	Cerebral Computations
95.524	(CSI5124)	Computational Aspects of Geographic Information Systems
95.526	(CSI5183)	Genetic Algorithms and Artificial Life
CSI5114	(95.554)	Automated Office Systems
CSI5161	(95.566)	Topics in System Simulation and Optimization
CSI5181	(95.575)	Artificial Intelligence Applications in Software Development
CSI5304	(95.562)	Knowledge Engineering
CSI5386	(95.555)	Natural Language Processing
CSI5387	(95.576)	Concept Learning Systems
CSI5514	(95.554)	Bureautique
CSI5580	(95.510)	Sujet en intelligence artificielle
CSI5581	(95.575)	Applications de l'intelligence artificielle dans le développement des systèmes
CSI5787	(95.576)	Apprentissage Symbolique Automatique
ELG5119	(92.519)	Stochastic Processes

Computer Systems

94.457		Introduction to the Architecture of Computer Systems
94.470		Introduction to Telecommunications
95.408		Performance Modelling
94.511	(ELG6111)	Computer System Design for Performance
94.519	(ELG6119)	Teletraffic Engineering
94.521	(ELG6121)	Computer Communications
94.527	(ELG6127)	Distributed Processing Systems
94.538	(ELG6138)	Computer Architecture and Parallel Processing
94.558	(ELG6158)	Digital Systems Architecture
94.571	(CSI5117)	Operating System Methods for Real-Time Applications
94.576	(ELG6176)	Analytical Performance Models of Computer Systems
94.577	(ELG6177)	Teleprocessing Software Design
94.581	(ELG6181)	Advanced Topics in Computer Communications
95.503	(CSI5308)	Principles of Distributed Computing
95.509	(CSI5141)	Associative Data Structures and Advanced Databases
95.511	(CSI5311)	Distributed Databases and Transaction Processing Systems
95.512	(CSI5312)	Distributed Operating Systems
95.515	(CSI5132)	Parallel Processing Systems
95.574	(CSI5131)	Parallel Algorithms and their VLSI Implementation
95.610	(CSI7131)	Advanced Parallel and Systolic Algorithms
95.662	(CSI7170)	Advanced Topics in Distributed Computing
97.587	(ELG6387)	Microprocessor Electronics
CSI5114	(95.554)	Automated Office Systems
CSI5133	(95.568)	Simulation and Testing of Logic Circuits
CSI5135	(95.565)	High Level Language Machines
CSI5170	(95.580)	Distributed Data Processing
CSI5171	(95.583)	Software for Communication Networks
CSI5388	(95.581)	Topics in Machine Learning
CSI5514	(95.554)	Bureautique
CSI5535	(95.565)	Les machines de haut niveau
ELG5192	(92.577)	Microprocessor-based Systems
ELG5193	(92.578)	Multi-microprocessor Systems
ELG5374	(92.567)	Computer-Communication Networks
ELG5378TH	(92.559)	Image Processing Techniques and Image Communications

Theses, Projects and Topics

95.590	(CSI5140)	Selected Topics in Computer Science
95.591	(CSI5901)	Directed Studies (M.C.S.)
95.592	(CSI5900)	Graduate Project (M.C.S.)
95/70/94.595		
	(CSI7999)	M.C.S. Thesis
95.661	(CSI7160)	Advanced Topics in the Theory of Computing
95.662	(CSI7170)	Advanced Topics in Distributed Computing
95.663	(CSI7161)	Advanced Topics in Programing Systems and Languages
95.664	(CSI7162)	Advanced Topics in Computer Applications
95.665	(CSI7163)	Advanced Topics in Computer Systems
95.691	(CSI7901)	Directed Studies (Ph.D.)
95.692	(CSI7900)	Graduate Project (Ph.D)
95.699	(CSI9999)	Ph.D. Thesis
CSI9998		Examen général de doctorat/Ph.D. Comprehensive Examination

School of Computer Science

Herzberg Building 538
Telephone: 788-4333
Fax: 788-4334

The School

Director of the School:
J.R. Pugh
Supervisor of Graduate Studies:
S.P. Dandamudi

The School of Computer Science offers degrees leading to a Master of Computer Science or a Ph.D. in Computer Science through the Ottawa-Carleton Institute for Computer Science. The Institute is jointly administered by the School and the Department of Computer Science at the University of Ottawa. For further information, including admission and program requirements, see page 181.

A program leading to the M.Sc. in Information Systems Science is offered in cooperation with the Department of Mathematics and Statistics and the Department of Systems and Computer Engineering, see page 200.

The research expertise of the school faculty is concentrated in the following areas:
Algorithms and Complexity
Computational geometry and algebra, combinatorial optimization, distributed and parallel algorithms, multi-dimensional data structures, stochastic automata, graph theory, partial orders.
Intelligent Systems
Expert systems, knowledge acquisition tools, knowledge based assistants, connectionism and neural networks, natural language understanding, learning and adaptability, robotics, pattern recognition.
Object-Oriented Systems
Visual programing, filing systems, databases, user interfaces, simulation, animation, software engineering, office automation.
Distributed Systems
Operating systems, databases, systolic architectures, tools for performance studies, distributed programing languages, parallel computing, communication complexity, networks.
In addition to its undergraduate laboratories the School maintains three research laboratories, containing PC-AT clones, MacII's, Tektronix and SUN workstations, and laser printers all integrated via a department and campus area network.

Graduate Courses*

The complete list of courses available through the Ottawa-Carleton Institute for Computer Science is given on page 183. The following courses are offered by the School of Computer Science.

This is a general listing of courses. Please consult the School of Computer Science for information on actual course offerings for each term.

• Computer Science 95.501F1 (CSI5113)
Foundations of Programing Languages
This course will study current topics in the theory and practice of programing language design and implementation. Different styles of languages: imperative, applicative, logic, constraints, object-centred, dataflow, production systems. Abstraction mechanisms; primitives; extensibility; procedural versus declarative semantics; interpretation; compilation; program transformation.
Prerequisite: Computer Science 95.207 or the equivalent.

• Computer Science 95.502W1 (CSI5119)
User Interface Facilities
This project oriented course is concerned with the concepts, methodologies and algorithms for the specification, design and implementation of visual User Interface Facilities (UIF). The principal focus is on the software engineering of user interfaces. UIF applications in computer aided instruction, computer-aided design and visual programing are used to illustrate both general and special purpose user interfaces. Current commercial and research approaches are studied from the perspective of the user, the application designer and the systems programer. The alternative programing metaphors of control flow, data flow, objects and constraints are introduced and their importance is discussed in the context of integrated user interface.
Prerequisite: Computer Science 95.501 or equivalent.

• Computer Science 95.503F1 (CSI5308)
Principles of Distributed Computing
Formal models; semantics of distributed computations; theoretical issues in design of distributed algorithms; computational complexity; reducibility and

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* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

equivalence of distributed problems. Related topics: systolic systems and computations, oligarchical systems and control mechanisms.
Prerequisite: Permission of the School.

• Computer Science 95.504W1 (CSI5305)
Topics in Arithmetic Complexity
Most scientific calculations rest on the basic arithmetic operations carried out on numbers, polynomials, and matrices. The course begins by studying the complexity of these operations. It proceeds to examine the related problem of finding the factors of an integer or polynomial, and it discusses the applications of this problem to cryptography and coding theory. The course concludes with a selection of other fundamental problems, such as polynomial evaluation, and the exploitation of parallel hardware.
Prerequisite: Computer Science 95.484 or equivalent.

• Computer Science 95.505F1 (CSI5390)
Automata Models of Learning Systems
This course will introduce students to computerized adaptive learning. Learning models in mathematical psychology will be discussed. Mathematical tools such as Markov chains and the solution of difference equations will be reviewed. The heart of the course will involve deterministic and stochastic automata, operation in random environments, norms of learning, linear and nonlinear learning schemes, convergence problems, and discretized automata with ergodic and non-ergodic properties. Applications of learning automata in file allocation, game playing, path finding, optimization and decision making will be discussed.
Prerequisite: Mathematics 70.260 or 70.350, or Engineering 94.553, or equivalent.

• Computer Science 95.506W1 (CSI5306)
Natural Language Understanding
This course will introduce the students to current research in natural language processing. The emphasis of the course will be on semantic and pragmatic rather than syntactic issues and on analyzing connected discourse rather than single sentences. Several existing natural language analyzers and their applications to text analysis, CAI, knowledge acquisition, database retrieval and intelligent assistants will be described in detail. Topics will include: meaning representation; representation of pragmatic information and speech act theory; flexible parsing; determination of focus and reference; task-oriented dialog systems; dynamic memory issues. Students will be required to implement a prototype natural language analyzer.
Prerequisite: Computer Science 95.407 or 95.501, or equivalent.

• Computer Science 94/95.507F1 (CSI5307)
Expert Systems
This course will include: survey of some land mark expert systems; types of architecture and knowledge representation; inferencing techniques; approximate reasoning; truth maintenance; explanation facilities; knowledge acquisition. A project to implement a small expert system will be assigned.
Prerequisite: Computer Science 95.407 or 95.501 or permission of the School.

• Computer Science 95.508W1 (CSI5164)
Computational Geometry
This course will study the design and analysis of algorithms for solving geometrical problems. These algorithms have applications in such areas as computer graphics, pattern recognition and robotics. Topics will include: visibility problems, hidden line removal, classes of polygons, testing polygons for structural properties, convex hull problems, movability of objects through a set of obstacles, point inclusion in polygons, decomposition of objects into "meaningful" components, triangulation and guard problems.
Prerequisite: Computer Science 95.384 or equivalent.

• Computer Science 95.509F1 (CSI5141)
Associative Data Structures and Advanced Databases
This course addresses concepts and advanced topics in the design, implementation and analysis of physical storage schemes with emphasis on their application to specialized database and information retrieval systems. The topics covered include associative searching techniques; multidimensional storage structures; design and analysis of algorithms for spatial data modelling; formulation and optimization of database queries; parallel hardware and distributed approaches for physical data organization and information retrieval. Some case studies of their applications to geographic information systems, object bases and multimedia databases are also discussed.
Prerequisites: Computer Science 95.305 and 95.384, or equivalent.

• Computer Science 95.510W1 (CSI5180)
Topics in Artificial Intelligence
A programing oriented introduction to selected topics in Artificial Intelligence (A.I.). Topics for consideration include: A.I. programing techniques, pattern matching systems, natural language systems, rule based systems, constraint systems, learning systems, and cognitive systems. Assignments will be both (a) programing oriented requiring implementations and/or extensions of prototypes in Lisp and/or Prolog

and (b) research oriented requiring readings of special topics in current A.I. journals.
Prerequisite: Computer Science 95.501 or equivalent.

• Computer Science 95.511F1 (CSI5311)
Distributed Databases and Transaction Processing Systems
The course addresses the principles involved in the design and implementation of distributed databases and transaction processing systems. Topics covered include: distributed system architectures and models; distributed file systems; atomicity of distributed transaction; design of stable storage; synchronization mechanisms; concurrency control algorithms in distributed systems. Further topics cover issues of multiple copy updates; applications and protocols; error recovery; reliability and protection in distributed systems.
Prerequisites: Computer Science 95.305, 5.401, and 95.403 or equivalent.

• Computer Science 95.512W1 (CSI5312)
Distributed Operating Systems
A course emphasizing the design issues of advanced multiprocessor distributed operating systems: multiprocessor system architectures; the process model; the object model; synchronization and message passing primitives; memory architectures and management; distributed filesystems; protection and security; distributed concurrency control; deadlock and recovery; remote tasking; dynamic reconfiguration; performance measurement, modelling, and system tuning.
Prerequisite: Computer Science 95.300 or equivalent.

• Computer Science 95.513F1 (CSI5313)
Cryptography
Classical cryptosystems: substitution ciphers, homophonic ciphers, product ciphers, DES. Public key schemes: RSA, Knapsack codes. Digital signatures, fair communication protocols, key management.
Prerequisite: Permission of the School.

• Computer Science 95.514W1 (CSI5314)
Object-Oriented Systems
An examination of advanced topics and current research in object-oriented programing systems, languages and applications. Potential topics include: object-oriented design; comparative evaluation of object-oriented systems; compiled versus interpretive systems; manifest versus latent types; prototypes versus classes; inheritance mechanisms; persistent objects; concurrency; distributed objects; reflective architectures.
Prerequisite: Computer Science 95.501 or equivalent.

• Computer Science 95.515W1 (CSI5132)
Parallel Processing Systems
The aim of this course is to provide an introduction to the issues involved in designing and using parallel processing systems. Topics will be selected from the following: taxonomy and applications of parallel systems; SIMD systems; multiprocessor systems; multicomputer systems; computation versus communication issues in parallel processing; scheduling parallel systems; spinning versus blocking; interconnection networks; hot-spot contention.
Prerequisite: Permission of the School.

• Computer Science 95.516W1 (CSI5123)
Languages for Parallel Computing
This course will survey the major language paradigms for parallel computing: sequential imperative languages (i.e. automatically parallelizing conventional sequential languages), parallel imperative languages, functional languages (reduction and dataflow), communicating sequential processes (CSP), object and message-passing based languages, logic languages, and massive data-level parallelism. The course will cover the fundamental language issues in parallel computing systems, such as parallelism detection, determinism, data partitioning, task scheduling, task granularity, synchronization methods, resource management, and debugging for each paradigm. The course will study actual languages and systems, both past and present, and cover implementation issues as time permits.
Prerequisite: Computer Science 95.501.

• Computer Science 95.520 (CSI5182)
Cerebral Computations
Cerebral computation is concerned with computational models of the human brain. It is a programing course devoted to the design and implementation of aspects of the brain viewed as a cerebral computer. It includes such topics as neural models, neural architectures, pre-attentional vision processing, audio and touch processing, hand-eye coordination, mental imagery, map modelling, world modelling, attentional mechanisms, associative mechanisms, affect processing, motor control, high-level planning, and models of simpler organisms. A fundamental aim is the investigation of mechanisms that exhibit plasticity and adaptability; i.e., the ability to change and improve over time.
Prerequisite: Permission of the School.

• Computer Science 95.522 (CSI5172)
Network Reliability
This course adopts a graph theoretic model of a communications network and addresses the problem of assessing the network's reliability when components are prone to failure. Topics include: graph theoretic models of computer networks, the

complexity of computing reliability, combinatorial algorithms for bounding the reliability, Monte Carlo methods, and applications such as optimal facility location in unreliable networks. This course will draw on results from graph theory, complexity theory, combinatorics, and statistics.
Prerequisite: Permission of the School.

• Computer Science 95.524W1 (CSI5124)
Computational Aspects of Geographics Information Systems
This course covers geographic information systems (GIS) from the computational perspective. It reviews relevant data representations and their operations on raster and vector devices; e.g. quadtrees, grid files, digital elevation models, triangular irregular network models. Emphasis is on the analysis and design of efficient algorithms for solving geographic information system problems for different models. These operations are largely geometric in nature; e.g. visibility queries, point location, facility location, etc. A large component of this course is concerned with current research in algorithmic GIS leading students to research topics and/or projects. Evening division, winter term.
Prerequisite: Computer Science 95.384 or equivalent.

• Computer Science 95.526W1(CSI5183)
Genetic Algorithms and Artificial Life
This course investigates algorithms based upon biological theories of evolution. We will implement different forms of Genetic Algorithms (GA) and Classifier Systems, and study advanced topics in this area, including parallel and hybrid GAs, GA deceptiveness, nonbinary representation schemes and knowledge-intensive genetic operators, different reproduction strategies, and bucket brigade and temporal difference methods of credit allocation. We will also study recent work in the field of Artificial Life. Artificial Life develops computational models of theories of population behaviour, ecological interaction, and adaptation, and studies the conditions under which global behaviours emerge from many local interactions.
Prerequisite: Computer Science 95.407 or equivalent.

• Computer Science 95.528W1(CSI5167)
Complexity of Boolean Functions
This course is intended to provide students with detailed knowledge of circuits as a model of computation for boolean functions. Circuits of interest are of polynomial size and constant or polylogarithmic depth. Topics of study include: basic boolean functions and reductions, synthesis of circuits, methods of Shannon and Lupanov, circuits for addition and multiplication, symmetric functions. Probabilistic

and algebraic techniques are used for the study of constant depth circuits for symmetric functions, parity, majority, etc. Evening division, winter term.
Prerequisite: Computer Science 95.384 or equivalent.

• Computer Science 95.573F1 (CSI5163)
Algorithm Analysis and Design
Topics of current interest in the analysis and design of sequential and parallel algorithms for non-numerical, algebraic and graph computations. Lower bounds on efficiency of algorithms. Complexity classes.
Prerequisite: Permission of the School.
Also offered at the undergraduate level, with different requirements, as 95.484, for which additional credit is precluded.

• Computer Science 95.574W1 (CSI5131)
Parallel Algorithms and their VLSI Implementation
Introduction: models of computation, levels of parallelism, performance measures for parallel algorithms, need for parallel algorithms. Parallel algorithms: techniques in matrix multiplication, solution of linear equations, transforms and differential equations, systolic arrays for the implementation of parallel algorithms in the areas of matrix arithmetic, transforms and relational database operations. VLSI implementations: VLSI and parallel computing structures, mapping of high-level computations into VLSI structures.
Prerequisite: Computer Science 95.484 or equivalent.

• Computer Science 95.582W1
Introduction to Information and Systems Science
An introduction to the process of applying computers in problem solving. Emphasis is placed on the design and analysis of efficient computer algorithms for large, complex problems. Applications in a number of areas are presented: data manipulation, databases, computer networks, queuing systems, optimization.
(Also listed as Mathematics 70.582, Engineering 94.582, Information and Systems Science 93.582)

• Computer Science 95/70.587F1 (CSI5104)
Formal Language and Syntax Analysis
Computability, unsolvable and NP-hard problems. Formal languages, classes of languages, automata. Principles of compiler design, syntax analysis, parsing (top-down, bottom-up), ambiguity, operator precedence, automatic construction of efficient parsers, LR, LR(O), LR(k), SLR, LL(k); syntax directed translation.
Prerequisite: Computer Science 95.302 or Mathematics 70.485 or 70.565, or equivalent.

- Computer Science 95.590F1, W1, S1 (CSI5140)
Selected Topics in Computer Science
Selected topics, not covered by other graduate
courses, will be offered. Details will be available at
the time of registration.

- Computer Science 95.591F1, W1, S1 (CSI5901)
Directed Studies (M.C.S.)
A course of independent study under the supervi-
sion of a member of the School of Computer Science.

- Computer Science 95.592F1, W1, S1 (CSI5900)
Graduate Project (M.C.S.)

- Computer Science 70/94/95.595F, W, S
(CSI7999)
M.C.S. Thesis

- Computer Science 70/94/95.598F, W, S
M.Sc. Thesis in Information and Systems Science

- Computer Science 95.610F1 (CSI7131)
Advanced Parallel and Systolic Algorithms
This course is a continuation of 95.574.
Prerequisite: Computer Science 95.574.

- Computer Science 95.661F1, W1, S1 (CSI7160)
Advanced Topics in the Theory of Computing

- Computer Science 95.662F1, W1, S1 (CSI7170)
Advanced Topics in Distributed Computing

- Computer Science 95.663F1, W1, S1 (CSI7161)
Advanced Topics in Programing Systems and
Languages

- Computer Science 95.664F1, W1, S1 (CSI7162)
Advanced Topics in Computer Applications

- Computer Science 95.665F1, W1, S1 (CSI7163)
Advanced Topics in Computer Systems

- Computer Science 95.691F1, W1, S1 (CSI7901)
Directed Studies (Ph.D.)

- Computer Science 95.692F1, W1, S1 (CSI7900)
Graduate Project (Ph.D.)

- Computer Science 95.699F, W, S (CSI9999)
Ph.D. Thesis

The Ottawa-Carleton Geoscience Centre

Tory Building 320
Telephone: 788-4400
Fax: 788-4490

UNIVERSITÉ D'OTTAWA
UNIVERSITY OF OTTAWA

CARLETON UNIVERSITY

The Centre

Director of the Institute:
R.L. Brown

The Centre, established in 1982, represents the combined research strengths of Carleton University and the University of Ottawa. Research facilities are shared between the two campuses and graduate students are enrolled in the University where their faculty supervisors hold appointments. Programs are available leading to the degrees of M.Sc. and Ph.D. in most areas of geoscience. Six areas of research are emphasized, each involving a major component of field work: Precambrian studies, tectonics, resource geology, northern studies, environmental geoscience, and geochemistry. The Derry/Rust Research Group for Sedimentary Resources and the Geotechnical Science Laboratories are research units in the Centre.

All thesis, seminar and examination requirements in the Centre may be met either in French or English. Courses are offered in French wherever appropriate.

Members of the Centre

F.P. Agterberg, *Geomathematics, Evaluation of Nonrenewable Resources, Automated Stratigraphic Correlation*
R.W. Arnott, *Clastic Sedimentology, Experimental Sedimentology*
G.E. Bauer, *Geotechnical Engineering, Groundwater Flow, Soil Mechanics*
Keith Bell, *Isotope Studies, Petrology of Alkaline Rocks and Carbonatites, Geochronology*
Keith Benn, *Structural Geology, Structural Petrology, Anisotropy of Magnetic Susceptibility, Basement Tectonics*
R.G. Berman, *Metamorphic Petrology, Experimental Petrology*
John Blenkinsop, *Mass Spectrometry, Geochronology, Isotope Geochemistry*
G.F. Bonham-Carter, *Spatial Information Systems, Spatial Data Modelling*
A.C. Brown, *Sedimentary Mineral Deposits*
R.L. Brown, *Tectonics and Structural Geology*
C.R. Burn, *Permafrost and Ground Ice, Yukon and Western Arctic*

E.M. Cameron, *Precambrian Geochemistry, Genesis of Gold Deposits, Exploration Geochemistry*
S.D. Carr, *Cordilleran and Grenville Tectonics, U-Pb Geochronology*
G.Y. Chao, *Mineralogy, Crystallography*
I.D. Clark, *Hydrogeology, Environmental Isotope Geochemistry*
André Desrochers, *Carbonate Sedimentology and Diagenesis, Canadian Arctic*
G.R. Dix, *Sedimentology and Stratigraphy, Emphasis on Sedimentary Modern and Ancient Environments*
O.A. Dixon, *Invertebrate Paleontology, Stratigraphy, Canadian Arctic*
J.A. Donaldson, *Precambrian Stratigraphy and Sedimentology*
M.J. Drury, *Geothermics and Borehole Geophysics*
C.R. Duguay, *Remote Sensing, Geographic Information Systems*
A.D. Fowler, *Geochemistry, Archean Metavolcanic Belts, Non-linear Dynamics*
J.M. Franklin, *Ore Deposits, Hydrothermal Alteration, Sea Floor Hydrothermal Activity*
H.M. French, *Permafrost and Periglacial Phenomena*
Peter Fritz, *Isotope, Geochemistry, Isotope Hydrology, Aqueous Geochemistry and Paleoclimatology*
W.K. Fyson, *Structural Analyses in Metamorphic Terrains*
M.-A. Geurts, *Palynology and Geomorphology, Travertine*
H.J. Gibson, *Subaqueous Volcanic Processes and Metallic Mineral Deposits*
W.D. Goodfellow, *Geochemistry of Modern and Ancient Sediment-hosted Deposits, Mass Extinction*
S.K. Hanmer, *Shear Zones, Progressive Strain, Grenville Problems*
Keiko Hattori, *Isotope Geochemistry, Mineral Deposits, Archean Geology*
D.D. Hogarth, *Mineralogy: Igneous and Metamorphic Petrology, Alkalic Rocks*
C.W. Jefferson, *Sediment-hosted Ore Deposits, Resource Assessment, Exploration Geochemistry*
P.G. Johnson, *Glacial Geomorphology, Slope Mass Movements, Glacier Hydrology*
I.R. Jonasson, *Geochemistry, Ore Deposits*
D.J. King, *Remote Sensing, Vegetation Damage Assessment including Geobotanical Techniques, Geographic Information Systems*
Ralph Kretz, *Mineral Chemistry, Metamorphism, Environmental Studies*
Jarmila Kukalova-Peck, *Paleontology, Fossil Insects*
A.E. Lalonde, *Petrology and Mineralogy of Plutonic Rocks*

B.M. Lauriol, *Geomorphology*
Joyce Lundberg, *Karst, Quaternary Studies, Geochronology*
D.J. McLaren, *Geological Time, Event Stratigraphy*
F.A. Michel, *Isotope Geochemistry, Groundwater and Permafrost Studies*
R.R. Parrish, *Geochronology, Tectonics, Cordilleran Geology*
R.T. Patterson, *Micropaleontology Specializing in Foraminifera*
Giorgio Ranalli, *Rheology of the Earth, Geodynamics, Plate Tectonics*
D.G. Rancourt, *Mössbauer Spectrometry, Mineralogy, Geobarometry, Geothermometry, Micas*
R.J. Rice, *Precambrian Sedimentology*
M.J. Robin, *Contaminant Hydrogeology, Geostatistics, Geomathematics*
D.A. Russell, *Vertebrate Paleontology*
D.F. Sangster, *Sediment-hosted Mineral Deposits, Geochemistry, Stable Isotopes*
C.J. Schröder-Adams, *Micropaleontology, Biostratigraphy, Paleoecology, Foraminifera, Sequence Stratigraphy*
W.W. Shilts, *Quaternary Geology, Glacial Sedimentology, Mineral Exploration in Glaciated Terrains, Environmental Geochemistry*
G.B. Skippen, *Metamorphic Petrology, Aqueous Geochemistry*
M.W. Smith, *Permafrost, Microclimate, Soil Freezing*
B.E. Taylor, *Stable Isotope Geochemistry, Crystal Fluids, Igneous/Metamorphic Processes, Mineral Deposits*
R.P. Taylor, *Fluid-rock Systems, Mineral Deposits*
J.K. Torrance, *Soil Chemistry, Clays, Oxide Minerals and Geotechnical Problems*
Jan Veizer, *Sedimentary Geochemistry, Carbonates, Diagenesis, Ores, Precambrian Sedimentology*
D.H. Watkinson, *Metallic Mineral Deposits*
P.J. Williams, *Soil Freezing and Geotechnical Problems, Cold Region Pipelines*

Research Associate
J.W. Card, *Radiogenic Isotope Geochemistry*

Postdoctoral Fellows
J.L. Burr, *Structural Geology, Metamorphic Petrology*
B.L. Cousens, *Igneous Petrology; Isotope Geochemistry*

Master of Science

Admission Requirements
The normal requirement for admission to the program is an honours B.Sc. degree, with at least high honours standing, in geology or a related discipline.

Program Requirements
- A research thesis, which will be defended at an oral examination
- The equivalent of two full courses, one of which may be at the senior undergraduate level
- Participation in the geoscience seminar series and presentation of a seminar

Academic Standing
A grade of B– or better must normally be received in each course counted towards the master's degree.

Doctor of Philosophy

Admission Requirements
The normal requirement for admission to the Ph.D. program is an M.Sc. degree in earth sciences or a related discipline. Students who show outstanding academic performance and research promise while in the M.Sc. program may be permitted to transfer to the Ph.D. program without completing the M.Sc.

Program Requirements
- A research thesis, to be defended orally before an examination board which will include an external examiner
- A comprehensive examination, with emphasis on areas chosen by the student's advisory committee. The examination is normally taken within the first twelve months of study
- Two graduate full courses
- Participation in the geoscience seminar series and presentation of a seminar

Residence Requirement
The normal residence requirement for the Ph.D. degree is at least four terms of full-time study.

Graduate Courses

- Geology 67.511 (GEO5111)
Crystallography
Principles and techniques of X-ray crystallography; interpretation of X-ray photographs and application to the study of minerals.
G.Y. Chao.

- Geology 67.512 (GEO5112)
Rock-Forming Minerals
Recent work on structure, chemistry and inter-relationships of igneous and metamorphic rockforming minerals.
(To alternate with 67.513/GEO5113 or GEO5713)
D.D. Hogarth.

* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- Geology 67.513 (GEO5113)
Mineralogy of Plutonic Rocks
A seminar course reviewing the applications of mineralogical studies to the petrogenesis of felsic and mafic plutonic rocks. Topics include: structural state of feldspar minerals, applications to granitic rocks; chemical evolution of mica, pyroxene and amphibole minerals in plutonic bodies; phase relationships; review of the mineralogy of specific plutonic rock-types (e.g. anorthosites, syenites and hyperaluminous granites).
(To alternate with 67.512/GEO5112)
A.E. Lalonde.

- Geology 67.513 (GEO5713)
Minéralogie des Suites Plutoniques
Un cours ayant pour but d'accentuer la contribution des études minéralogiques détaillées à l'élaboration de la pétrogénèse des roches plutoniques mafiques ou felsiques. Parmi les sujets couverts figurent: la mise en ordre des feldspaths, son évaluation et ses applications à l'étude des granites, l'évolution chimique des micas, pyroxènes et amphiboles, relations de phases ainsi qu'une revue de la minéralogie de suites plutoniques spécifiques telles que les anorthosites, les syénites et les granites hyperalumineux.
A.E. Lalonde.

- Geology 67.521 (GEO5121)
Igneous Petrogenesis
Concentration on one or more of: origin and differentiation of basaltic magma; origin of granites; computer modelling of partial melting and fractional crystallization; magmatism in time and space. Laboratory and lecture material linked together in project form.
(Also offered as GEO5721)
A.D. Fowler, R.P. Taylor, A.E. Lalonde.

- Geology 67.521 (GEO5721)
Pétrogenèse Ignée
Un cours basé sur un (ou plusieurs) des thèmes suivants: origine et différenciation de magma basaltique; origine de granites; simulation par ordinateur de fusion partielle et cristallisation fractionnée; magmatisme en temps et en espace. Laboratoire et cours qui s'enchainent sous forme d'un projet.
A.D. Fowler and A.E. Lalonde.

- Geology 67.522 (GEO5122)
Physical Volcanology
The distribution, classification and physical characteristics of volcanos and other volcanic landforms; lava flows, tephra, breccias, and other rocks formed through volcanic activity. Volcanic environments; recognition of ancient volcanic features; case histories.

- Geology 67.523 (GEO5123)
Metamorphic Petrology
Thermodynamics and kinetics of mineral reactions; metamorphic zones and isograds; mass transfer; regional and global aspects of metamorphism.
Ralph Kretz and G.B. Skippen.

- Geology 67.524 (GEO5124)
Metallic Mineral Deposits
Relationships of some metallic mineral deposits to igneous rocks; topics range from oxides and sulfides in and around intrusions to stratiform volcanogenic deposits. Course concludes with a field trip to northern Ontario and Quebec at end of winter term.
D.H. Watkinson.

- Geology 67.527 (GEO5127)
Physical Processes in Igneous Petrology
Lecture, reading and seminar course dealing with the physical processes responsible for generation, ascent, crystallization and cooling of igneous rocks. Topics covered include partial melting in the upper mantle and separation of the liquid; magma properties, structure, viscosity, temperature, density, and heat; magma processes, intrusion, extrusion, diffusion, convection types, assimilation, nucleation, and crystal growth; cooling of magmas, conduction, convection, permeability, vapour phase exsolution, meteoric water, development of spinifex, spherulites. These processes will be related to field examples wherever possible.
A.D. Fowler.

- Geology 67.527 (GEO5727)
Les Processus Physiques en Pétrologie Ignée
Les processus responsables directement à la génération, l'ascension, la croissance et le refroidissement des roches ignées seront présentés dans les cours, les colloques et dans la discussion de la littérature récente. Les sujets suivants seront traités; fusion dans le manteau et la séparation du liquide; propriétés des magmas, la structure, la viscosité, la température, la densité et la chaleur; les processus magmatiques, l'intrusion, l'extrusion, la diffusion, la convection, la perméabilité, l'exsolution d'une vapeur, l'eau météorique, le développement de spinifex et les sphérulites. Les processus seront étudiés à l'aide d'exemples de terrain chaque fois que ça sera possible.
A.D. Fowler.

- Geology 67.528 (GEO5128)
Ores in Sediments
Ore-forming processes in sediments and sedimentary rocks. The generation, transport and deposition of ore elements relative to processes such as redox traps, basin water expulsion, direct precipitation from sea-water, and placer sedimentation are discussed in seminar

format. All major sedimentary deposit-types are included.
Prerequisite: An undergraduate course in mineral deposits.
D.F. Sangster and A.C. Brown.

• Geology 67.530 (GEO5130)
Dynamics of Sedimentary Systems
Weathering, rivers, ocean and atmosphere, sedimentation and tectonism, basins and their sediments, P-T evolution, compaction, diagenesis, brines and fluid dynamics, mineralization, rock cycle and evolution through geologic time.
Jan Veizer.

• Geology 67.531 (GEO5131)
Sedimentology and Stratigraphy
Selected problems in sedimentary geology, emphasizing sedimentary structures, facies models and diagenesis. The application of modern techniques of stratigraphic, petrologic and statistical analysis.
J.A. Donaldson.

• Geology 67.532 (GEO5132)
Paleoecology
Emphasis on marine fossils as paleoenvironmental indicators: effects of substrate type, energy conditions, light, temperature, biotic associates and other environmental factors on the occurrence and distribution of organisms and their fossil remains.
O.A. Dixon and R.T. Patterson.

• Geology 67.533 (GEO5133)
Advanced Micropaleontology
Selected topics in micropaleontology covered in greater detail than in introductory micropaleontology. Areas addressed include the paleoecology, biogeography and biology of foraminifera and other microfossil groups, as well as their application to biostratigraphy and paleoceanography.
R.T. Patterson.

• Geology 67.534 (GEO5134)
Fossil Fuels
Petroleum, natural gas, coal and unconventional fossil fuels; their origin, occurrence, and evaluation in the light of current geological thought.

• Geology 67.536 (GEO5136)
Paleobiology
Selected topics in paleobiology of marine fossils. Topics include extinctions, micro- and macro-evolutionary processes, long-term trends and cycles in the Phanerozoic, and functional morphology.
R.T. Patterson.

• Geology 67.539 (GEO5139)
Glacial Sedimentology
Systematic study of various glacial sedimentary environments and processes, with emphasis on the influence of geological substrate and regional drainage gradient on glacial erosion sediment characteristics and sediment distribution; significance of genesis of glacial sediments for stratigraphic correlations, mineral exploration, interpretation of environmental geochemistry, aggregate evaluation, and hydrogeology. Weekly two hour lectures supported by slides and extensive video records of glaciers and glacial processes. Local field trips and one weekend field excursion to Quebec to observe interrelationships of sedimentary facies.
W.W. Shilts.

• Geology 67.541 (GEO5141)
Permafrost Hydrology and Investigative Methods
An examination of groundwater flow in permafrost regions. The importance of groundwater in the formation of various types of ground ice, and the effect of groundwater flow on permafrost distribution.
F.A. Michel.

• Geology 67.542 (GEO5142)
Environmental Geoscience
A study-seminar course in which students will examine, in depth, certain environmental problems, including geological hazards, mineral and energy consumption and environmental degradation. The relation between development and the environment will be considered. Students will prepare a report and present a seminar on a subject of their choice, and will participate in a research project centred in the Ottawa area.
Ralph Kretz.

• Geology 67.543 (GEO5143)
Environmental Isotopes and Groundwater Geochemistry
Stable environmental isotopes (^{18}O, ^{2}H, ^{13}C, ^{34}S, ^{15}N) in studies of groundwater origin and flow, and geothermal studies. Groundwater dating techniques involving tritium and radio-carbon, and exotic radioisotopes (e.g. ^{36}Cl, ^{39}Ar, ^{85}Kr). Low temperature aqueous geochemistry and mineral solubility with emphasis on the carbonate system. Some application to paleoclimatology will be discussed.
Prerequisite: Fourth-year hydrogeology (67.420 or GEO4192) or equivalent.
I.D. Clark and F.A. Michel.

• Geology 67.544 (GEO5144)
Groundwater Resources
Advanced topics in the exploration and development of groundwater resources, including detailed aquifer

response analysis. Examination of hydrogeology in arid and undeveloped regions will also be included.
Prerequisite: Fourth-year hydrogeology (67.420 or GEO4192) or equivalent.
F.A. Michel and I.D. Clark.

• Geology 67.545 (GEO5145)
Contaminant Hydrogeology
A theoretical and applied course examining sources of groundwater contamination and mechanisms of transport. Inorganic, radioactive, and organic, biological contaminant behaviour will be discussed as well as regulations, monitoring methodologies, aquifer restoration and fundamental questions of high-level radioactive-waste disposal and municipal landfills.
Prerequisite: Fourth-year geochemistry or equivalent, or permission of instructor.
M.J. Robin and I.D. Clark.

• Geology 67.546 (GEO5146)
Numerical Methods in Hydrogeology
Application of numerical methods in hydrogeological problem solving, including a review of governing equations, initial and boundary conditions, and both finite element and finite difference methods. Additional topics to be explored include particle tracking, Laplace and Fourier transforms, and stochastic methods.
Prerequisite: Fourth-year hydrogeology or permission of instructor.
M.J. Robin.

• Geology 67.547 (GEO5147)
Geochemistry of Natural Waters
Aqueous speciation, solubility of metals, minerals and gas, reaction kinetics and equilibria. Chemistry and dynamics of groundwaters and hydrothermal fluids.
Keiko Hattori and I.D. Clark.

• Geology 67.548 (GEO5148)
Theory of Flow and Transport in Porous Media
Course designed for hydrogeologists and engineers who want in-depth understanding of the theory of fluid flow and solute transport through geological materials. Emphasis on porous media. Topics to be covered: types of fluids and porous media; saturated, unsaturated, and multi-phase flow; development of solute transport equations using continuum and stochastic approaches. Three hour lecture per week, reading and problem-solving assignments plus final examination.
Prerequisites: Fourth-year hydrogeology, second-year calculus, and first-year statistics, or permission of the instructor.
Michel Robin.

• Geology 67.551 (GEO5151)
Precambrian Geology
Problems of Precambrian geology, emphasizing classical and current studies in North America; comparative study of the Canadian Shield and other Precambrian shields; research projects, field trips and petrologic studies of representative rock suites.
J.A. Donaldson.

• Geology 67.552 (GEO5152)
Geology of Arctic Canada
Origins and development of the principal geological regions of the Canadian Arctic. Emphasis on the Phanerozoic record but other topics or problems may be included.
O.A. Dixon.

• Geology 67.553 (GEO5153)
Applications of Spatial Information Systems to Geology
This is a practical course in the application of PC-based geographic information systems to the analysis of regional geoscientific data. Spatial data capture, spatial data structures, spatial data analysis and modelling will be reviewed with reference to applications in mineral exploration, environmental and other problems. Students will undertake assignments and projects involving the use of a PC-based system.
G.F. Bonham-Carter.

• Geology 67.557 (GEO5157)
Tectonic Processes Emphasizing Metamorphism and Geochronology
Applications of empirical, analytical and quantitative techniques to problems in regional geology and crustal tectonics; orogenic processes; heat and metamorphism; isotopic geochronology as applied to thermal history; derivation and interpretation of P-T-t paths; comparison of modern, Phanerozoic and Precambrian tectonic processes.
Sharon Carr.

• Geology 67.560 (GEO5160)
Chemistry of the Earth
An investigation of the geochemical constitution of the Earth and how the Earth has evolved. Topics will include meteorites and the early history of the Earth; chemical and isotopic constraints on the geochemical evolution of the crust and mantle; Earth models and their limitations.
John Blenkinsop.

• Geology 67.562 (GEO5162)
Physical Geochemistry
Application of thermodynamics to geologic problems. Experimental study of mineral equilibria.
G.B. Skippen.

• Geology 67.563 (GEO5163)
Stable Isotope Geochemistry
Mechanisms of isotope fractionation in nature;
physical and chemical isotope fractionation, kinetic
isotope effects. Variation of stable isotope ratios
(hydrogen, carbon, oxygen and sulphur) in nature.
Preparation techniques of natural samples for isotope
analysis. Applications of stable isotopes to study
magma genesis, ore genesis, nature of water and
formation fluids and sedimentary environments.
Keiko Hattori.

• Geology 67.566 (GEO5166)
Exploration Geochemistry
Selected topics in applied geochemistry including:
biogeochemical exploration; element mobilities in
the surface environment; recent developments in
data interpretation; quality control of geochemical
data. Special attention to the use of geochemical
methods for gold exploration and possible
applications of stable and radiogenic isotopes to
mineral exploration.
E.M. Cameron.

• Geology 67.567 (GEO5167)
Hydrothermal Fluids
Liquids, vapours, supercritical fluids as the agents of
rock-water interaction and mass transfer in the crust.
Phase relations in systems such as $NaCl-H_2O-CO_2$
and thermodynamic constraints on geological fluids.
Applications to mineral equilibria and the microscopic
study of fluid inclusions.
G.B. Skippen.

• Geology 67.568 (GEO5168)
Mineralized Hydrothermal Systems
Geology of active geothermal systems, generation
of hydrothermal fluids, geochemistry of hydrothermal
fluids, stability and solubility of minerals in base-metal
and precious-metal mineralization, interpretation of
fluid inclusion data.

• Geology 67.569 (GEO5169)
Radioisotope Geochemistry
Nucleosynthesis; chemical differentiation of the
Earth. Evolution of large scale reservoirs. Isotopic
tracers ($^{143}Nd/^{144}Nd$, $^{87}Sr/^{86}Sr$, common Pb).
Geochronology; fundamentals and application of
Sm/Nd, Rb/Sr, U/Pb, K/Ar and Lu/Hf methods.
Evolution of the solid Earth from the isotopic
perspective.
Before 1992-93 67.569/GEO5169 was listed as
Geology 67.565/GEO5165.
Keith Bell.

• Geology 67.571 (GEO5171)
Physics of the Earth
The physics and dynamics of the solid Earth:
seismology; gravitational and magnetic fields, thermal
state. Geophysical constraints on the structure and
composition of the interior. Geodynamic processes.
Giorgio Ranalli.

• Geology 67.572 (GEO5172)
Tectonophysics
The physics of deformation; continuum mechanics
approach (elasticity, strength, plasticity, viscosity),
and micro-rheological approach (diffusion,
dislocations, and flow mechanisms). Applications
to tectonic processes.
Giorgio Ranalli.

• Geology 67.573 (GEO5173)
Structural Geology
Selected problems in structural geology treated in
seminar and laboratory sessions. Emphasis on
interpretation of fabrics developed during
synmetamorphic strain. Students investigate and
report on individual projects.
R.L. Brown and W.K. Fyson.

• Geology 67.574 (GEO5174)
Tectonics
An investigation of the structural style of mountain
belts and their tectonic setting; tectonics of
Precambrian deformed belts.
R.L. Brown and W.K. Fyson.

• Geology 67.575 (GEO5175)
Neotectonics
An investigation of present day geological processes
in a variety of plate boundary and intraplate settings.
Topics will include analysis of island arcs, currently
active mountain ranges in convergent plate boundary
settings, and rift systems in both continental and
oceanic settings. Consideration will be given to
depositional basins, structure, magmatism,
metamorphism and mineralization in these various
settings.
R.L. Brown.

• Geology 67.576 (GEO5176)
Rock Microfabric Analysis
An overview of rock fabric studies. Specific topics
will include shape and lattice-preferred orientations
of minerals, anisotropy of magnetic susceptibility
fabrics, mode of development and evolution of fabrics
with progressive deformation, fabric asymmetries,
and textural and petro-fabric criteria for determination
of deformational mechanisms. The course will include
a review of measurement techniques (U-stage, X-ray,
anisotropy of magnetic susceptibility, image analysis),
and of methods of statistical analysis (vector averaging,
pole and inverse pole diagrams, orientation
distribution function). Tectonic implications of
fabric type distributions and fabric development
will be stressed. The relationship between petrofabr-
ics and seismic anisotropy will be discussed. The

course may include one or more of the following; student seminars, reports based on bibliographic research or personal research, work on fabric of selected samples.
Keith Benn.

• Geology 67.576 (GEO5776)
L'Analyse des Microfabriques
Un regard sur l'étude de la fabrique des roches à l'échelle microscopique. Les sujets abordés comprendront: les orientations préférentielles de réseaux et de forme des minéraux, les fabriques d'anisotropie de susceptibilité magnétique, les modes de développement et d'évolution des fabriques lors de la déformation progressive, les asymmétries entre fabriques et sous-fabriques, et les critères pétrographiques pour détermination des mechanismes de déformation. Les techniques de mesure des fabriques (platine universelle, anisotropie de susceptibilité magnétique, rayons-X, analyse d'image) et les méthodes d'analyse statistique des données directionnelles (moyennes vectorielles, projections de pôles, diagrammes de densité, fonction de la distribution des orientations) seront discutées. La signification tectonique du développement et de la distribution spatiale des différents types de fabriques sera mise en évidence. Les relations entre pétrofabrique et anisotropie sismique seront aussi abordées. Ce cours comprendra un ou plus des travaux dirigés suivants: séminaires, rapports écrits basés sur une recherche bibliographique ou basés sur un travail personnel, mesures et analyses des fabriques des échantillons sélectionnés.
Keith Benn.

• Geology 67.581 (GEO5181)
Pattern Formation and Analysis
The course examines the quantitative measure of texture, and current ideas of pattern formation in the earth sciences. Spatial series, patterns, textures and other distributions are investigated. Pattern formation, self-organization, and rhythmic processes are studied. Students are expected to participate in seminars, term papers and assigned readings.
A.D. Fowler.

• Geology 67.590 (GEO5190)
Directed Studies
Directed reading and/or laboratory studies for full-credit course, under the guidance of selected extramural or intramural directors. A written description of the project must be submitted for departmental approval prior to registration.

• Geology 67.591 (GEO5191)
Directed Studies
Directed reading and/or laboratory studies for half-credit course, under the guidance of selected extramural or intramural directors. A written description of the project must be submitted for departmental approval prior to registration.

• Geology 67.593 (GEO5193)
Field Studies
Systematic investigations of geological problems, based on a minimum of fifteen days field work plus related library research and laboratory projects. Written report required.

• Geology 67.594 (GEO5294)
Problems in Historical Geology and Geological Time
Controversial ideas concerning the Earth and time; historical development of thought on the physical and biological evolution of the Earth. Understanding the stratigraphic column in regard to duration, age and correlation, including evidence from paleontology and sedimentology, particularly gaps in the succession and rhythmic or episodic events. Origin and nature of life; relationship between crustal events and evolution, including extinctions. Concepts and models in geology; responsibility of the geologist to humanity. Half-course given during fall and winter terms.
D.J. McLaren.

• Geology 67.599 (GEO7999)
M.Sc. Thesis
A thesis proposal must be approved by the research advisory committee by the end of the first year of registration.

• Geology 67.699 (GEO9999)
Ph.D. Thesis
A thesis proposal must be approved by the research advisory committee by the end of the first year of registration.

The following Geography courses are included in the Centre's program:

Department of Geography,
Carleton University:

• Geography 45.530W1
Soil Thermal and Hydrologic Regimes
Characteristics of soil regimes, particularly in freezing soils, role of soil properties; analytical and numerical methods, including computer simulation.
M.W. Smith.

- Geography 45.532F1
Soil Thermal and Hydrologic Properties
Instrumental techniques for investigation of hydro-
logical and thermal processes near the Earth's
surface, laboratory instrumentation and analysis of
laboratory and field procedures in geotechnical
science.
P.J. Williams.

- Geography 45.533W1
Periglacial Geomorphology
Permafrost, its distribution and significance,
seasonal ground freezing, ground thermal regime,
physical, thermodynamic, and geotechnical
properties of freezing and thawing soils, terrain
features ascribable to frost action, and solifluction
and patterned ground.
P.J. Williams.

- Geography 45.534W1
Aspects of Clay Mineralogy and Soil Chemistry
The role of clay minerals in soils will be considered
from a geotechnical and/or biological perspective.
J.K. Torrance.

- Geography 45.583F1, W1, S1
Remote Sensing and Image Analysis
Radiometric, geometric and resolution characteris-
tics of remotely sensed data, image processing algo-
rithms, analysis of spectral, textural, and contextual
image information, applications in vegetation map-
ping and environmental analysis.
Douglas King.

Department of Geography,
University of Ottawa:

- GEG 5001
Seminar: Earth Sciences (full-credit course)

- GEG 5303
Process in Geomorphology: Physics of Media,
Mechanics of Movement and Topographic
Expression
Discussion of the physics of medium deformation
as the basis of landscape-forming processes (ice,
water, and Earth surface materials), the mechanics
and effects of movement on the Earth's surface, and
concepts of landscape evolution due to the spatial
and temporal variations of these processes.

- GEG 5703
Concepts Climatiques en Paléogéographie de
l'Holocène dans le Nord du Canada
Le cours examine: 1) les causes et les mécanismes
des variations climatiques de la fin du pléistocène et
de l'holocène et leur impact sur les paysages; et 2)
les méthodes d'acquisition et d'interprétation des
données indirectes (palynologie, géomorphologie,
analyses isotopiques).

- GEG 7905
Pleistocene Periglacial Problems
The course will consist of a series of seminars
which will focus upon the problems of
Pleistocene paleogeographic reconstruction in
the mid-latitudes. The various lines of geo-
morphic and stratigraphic evidence which are
used to infer cold non-glacial (i.e. periglacial)
conditions in the Pleistocene will be critically
examined in the light of our understanding of
present day periglacial landforms and processes.
H.M. French.

Information and Systems Science Committee

See the Department of Mathematics and Statistics; Department of Systems and Computer Engineering; or the School of Computer Science

The Committee

Chair of the Committee:
Frantisek Fiala

The program of graduate study and research leading to the degree of Master of Science in Information and Systems Science is offered by the Committee with cooperation of the Department of Systems and Computer Engineering, the Department of Mathematics and Statistics, and the School of Computer Science.

The purpose of the program is to provide training in the use and application of computers to those who have not studied extensively in this field at the undergraduate level. The process of using the computer in problem-solving is stressed. The program is flexible, though individual concentrations are usually in one of three broad areas:

- computer applications in a particular field (e.g. communications, energy systems)
- algorithms and methodologies for solution of complex problems by computer (e.g. graph theory, operations research, optimization, simulation and modelling)
- computer methods and technologies (e.g. databases, software engineering, computer languages)

Close links are maintained with the scientific, industrial, and technological communities, and an effort is made to direct students to project work of current practical significance.

Qualifying-Year Program

Applicants who have a general (pass) bachelor's degree, or who otherwise lack the required undergraduate preparation, may be admitted to a qualifying-year program. Refer to the general section of this calendar for regulations governing the qualifying year.

Master of Science

Admission Requirements
Applicants should have an honours bachelor's degree, or equivalent, with at least high honours standing, in mathematics, engineering, physics, chemistry, computer science, operations research, experimental psychology, econometrics, management science, or a related discipline. Undergraduate preparation should include at least two full courses in computing and a minimum of three full courses in mathematics, at least one of which is at the third-year level or higher. In addition, the student is required to have some knowledge of quantitative applications, such as numerical analysis, simulation, operations research, etc.

Admissions to the program will be made through one of the three participating departments. Since space and laboratory facilities will be provided by one of the departments, students should apply through the department with which they wish to be most closely associated.

Program Requirements

The normal program comprises eight half courses and a thesis having a weight of one and one half full courses; additional requirements may also be stipulated, depending upon the individual student's background. With the approval of the Committee, students who have substantial work experience may be permitted to substitute three additional half courses in place of the thesis, one of which must be a graduate project course.

Students must take at least two half courses from the department in which they are registered, and at least one half course from each of the other two participating departments. Students must also take course 93.582 Introduction to Information and Systems Science.

Each student should consult with his/her faculty adviser in the selection of a course pattern related to his/her principal area of interest.

Each candidate submitting a thesis will be required to undertake an oral examination on the subject of his/her thesis.

Course work may be completed on either a full-time or part-time basis. Thesis research normally requires full-time residence at the University; however, a candidate may be permitted to carry out thesis work off campus provided that suitable arrangements are made for supervision and experimental work, and prior approval is given by the Committee.

Graduate Courses

• Information and Systems Science 93.582F1
Introduction to Information and Systems Science
An introduction to the process of applying computers in problem solving. Emphasis is placed on the design and analysis of efficient computer algorithms for large, complex problems. Applications in a number of areas are presented: data manipulation, databases, computer networks, queuing systems, optimization.
(Also listed as Mathematics 70.582, Engineering 94.582, Computer Science 95.582)

• Information and Systems Science 93.598F3, W3, S3
M.Sc. Thesis in Information and Systems Science
(Also listed as Mathematics 70.598, Engineering 94.598, Computer Science 95.598)

Department of Mathematics and Statistics

Undergraduate Courses
70.301   Real Analysis
70.302   Advanced Calculus
70.310   Modern Algebra
70.350   Mathematical Statistics
70.403   Functional Analysis
70.451   Probability Theory
70.452   Survey Sampling
70.453   Applied Multivariate Analysis
70.456   Non-Parametric Methods
70.457   Statistical Inference
70.458   Stochastic Models
70.459   Topics in Stochastic Optimization and Advanced Mathematical Modelling
70.470   Partial Differential Equations
70.471   Topics in Partial Differential Equations
70.473   Qualitative Theory of Ordinary Differential Equations
70.481   Topics in Combinatorics
70.482   Introduction to Mathematical Logic
70.483   Computable Functions
70.485   Theory of Automata
70.486   Numerical Linear Algebra
70.487   Game Theory
70.488   Graph Theory and Algorithms
70.496   Directed Studies

Graduate Courses:
70.507   Real Analysis I (Measure Theory and Integration)
70.508   Real Analysis II (Functional Analysis)
70.517   Algebra I
70.519   Algebra II
70.552   Sampling Theory and Methods
70.553   Linear Models
70.554   Stochastic Processes and Time Series Analysis
70.555   Design of Experiments
70.556   Robust Statistical Inference
70.557   Advanced Statistical Inference
70.558   Topics in Stochastic Processes
70.559   Multivariate Analysis
70.561   Stochastic Optimization
70.565   Theory of Automata
70.567   Game Theory
70.569   Topics in Combinatorial Mathematics
70.571   Stochastic Models
70.581   Linear Optimization
70.583   Nonlinear Optimization
70.584   Topics in Operations Research
70.585   Topics in Algorithm Design
70.586   Numerical Analysis
70/95.587 Formal Language and Syntax Analysis
70.588   Combinatorial Optimization
70.589   Combinatorial Optimization
70.590   Seminar
70.591   Directed Studies
70.593   Project

Department of Systems and Computer Engineering

Undergraduate Courses:
94.303   Introduction to Real-Time Systems
94.310   Systems Analysis
94.333   Real-Time Concurrent Systems
94.351   Communication Theory
94.361   Microprocessor Systems
94.401   Operating Systems
94.405   Discrete Simulation and its Applications
94.445   Discrete Time Systems
94.457   Architecture of Computer Systems
94.460   Digital Communications
94.462   Introduction to Computer Communications
94.480   Software Engineering
94.481   Software Engineering Project
94.485   Computer Systems Design Laboratory

Graduate Courses
94.501   Simulation and Modelling
94.504   Mathematical Programing for Engineering Applications
94.505   Optimization Theory and Methods
94/95.507 Expert Systems
94.511   Computer System Design for Performance
94.517   Queuing Systems
94.518   Topics in Information Systems
94.519   Teletraffic Engineering
94.521   Computer Communication
94.527   Distributed Processing Systems
94.531   System Design with Ada

94.535	Representations, Methods and Tools for Concurrent Systems
94.538	Computer Architecture and Parallel Processing
94.541	Adaptive Control
94.542	Advanced Dynamics with Applications to Robotics
94.552	Advanced Linear Systems
94.553	Stochastic Processes
94.554	Principles of Digital Communication
94.557	Fundamentals of Discrete Systems
94.558	Digital Systems Architecture
94.560	Adaptive Signal Processing
94.561	Neural Signal Processing
94.562	Digital Signal Processing
94.563	Digital Signal Processing Microprocessors, Software and Applications
94.564	Advanced Topics in Digital Signal Processing: Speech Communications and Applications
94.565	Advanced Digital Communication
94.566	Introduction to Mobile Communications
94.567	Source Coding and Data Compression
94.568	Wireless Communication Systems Engineering
94.569	Digital Television
94.571	Operating System Methods for Real-time Applications
94.573	Integrated Database Systems
94.574	Elements of Computer Systems
94.576	Analytical Performance Models of Computer Systems
94.577	Teleprocessing Software Design
94.579	Advanced Topics in Software Engineering
94.581	Advanced Topics in Computer Communications
94.583	Logic Programing
94.584	Advanced Topics in Communications Systems
94.585	Logic Programing: Techniques and Applications
94.596	Directed Studies

School of Computer Science

Undergraduate Courses

95.300	Operating Systems
95.304	Software Systems Design
95.305	Database Management Systems
95.401	Concurrent Programing
95.402	Computer Graphics
95.403	Transaction Processing Systems
95.405	A First Course in Robotics and Computer Vision
95.407	Applied Artificial Intelligence

| 95.408 | Performance Modelling |
| 95.409 | Introduction to Parallel and Systolic Computing |

Graduate Courses:

95.501	Foundations of Programing Languages
95.502	User Interface Facilities
95.503	Principles of Distributed Computing
95.504	Topics in Arithmetic Complexity
95.505	Automata Models of Learning Systems
95.506	Natural Language Understanding
94/95.507	Expert Systems
95.508	Computational Geometry
95.509	Associative Data Structures and Advanced Databases
95.510	Topics in Artificial Intelligence
95.511	Distributed Databases and Transaction Processing Systems
95.512	Distributed Operating Systems
95.513	Cryptography
95.514	Object-Oriented Systems
95.515	Parallel Processing Systems
95.516	Languages for Parallel Computing
95.520	Cerebral Computations
95.522	Network Reliability
95.573	Algorithm Analysis and Design
95.574	Parallel Algorithms and their VLSI Implementation

Due to the interdisciplinary nature of ISS, a student will in some cases benefit by taking an undergraduate course at the 300 or 400 level as part of his/her program. Where a 300 level course is to be taken, it will be extra to the degree requirements, or else arrangements will be made to enrich the subject matter, normally through a directed study course with the professor. Students may include two half courses at the 400 level in their program without penalty, with the approval of the department. The 300 and 400 level courses listed here are those most likely to interest ISS students; see the *Undergraduate Calendar* for a complete list. ISS students are prohibited from taking course 95.484 Design and Analysis of Algorithms due to overlap of course material with 93.582.

Ottawa-Carleton Institute of Mathematics and Statistics

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UNIVERSITÉ D'OTTAWA
UNIVERSITY OF OTTAWA

CARLETON UNIVERSITY

Requests for information and completed applications should be sent to the Director or Associate Director of the Institute.

The Institute

Director of the Institute:
Vlastimil Dlab
Associate Director:
Erhard Neher

Students who wish to pursue studies in pure mathematics, applied mathematics, probability and statistics at the graduate level leading to a M.Sc. or a Ph.D. degree can do so in a joint program offered by the Department of Mathematics and Statistics at Carleton University and the Department of Mathematics at the University of Ottawa under the auspices of the Institute for Graduate Studies and Research in Mathematics and Statistics. The Institute is responsible for supervising the programs, regulations and student admissions, as well as providing a framework for interaction between the two departments at the research level.

The list below of all members of the Institute along with their research interests can be used as a guide to possible supervisors.

In addition to the programs administered by the Institute, the Department of Mathematics and Statistics at Carleton University offers several other programs.

In cooperation with the Department of Systems and Computer Engineering and the School of Computer Science at Carleton University, students may pursue a program leading to an M.Sc. in Information and Systems Science. For information see page 200.

In cooperation with the School of Computer Science and the Department of Systems and Computer Engineering at Carleton University and the Department of Computer Science at the University of Ottawa, students may pursue a program leading to a Master of Computer Science (M.C.S.); for information see page 181.

The Department of Mathematics and Statistics also offers a cooperative master's program in statistics in collaboration with the federal government, emphasizing practical training through work experience, along with sound training in statistical inference and basic probability theory.

Members of the Institute

N.U. Ahmed, *Nonlinear Functional Analysis, Control Theory*

Mayer Alvo, *Nonparametric Statistics, Sequential Analysis*

Amitava Bose, *Stochastic Modelling, Probability Theory*

W.D. Burgess, *Algebra, Non-Commutative Rings*

C.E. Castonguay, *Demography*

Maurice Chacron, *Division Algebras With Involution*

M.P. Closs, *Native American Mathematics*

E.L. Cohen, *Diophantine Equations*

Miklòs Csörgö, *Probability and Statistics*

A.R. Dabrowski, *Invariance Principles, Weakly Dependent Variables*

Daniel Daigle, *Algebraic Geometry, Commutative Algebra*

D.A. Dawson, *Stochastic Processes and Probability Theory*

J.D. Dixon, *Group Theory, Algebra Computation*

Vlastimil Dlab, *Finite Dimensional Algebras, Representation Theory*

Zhicheng Gao, *Graph Theory*

C.K. Fong, *Operator Theory*

C.W.L. Garner, *Foundations of Geometry*

Thierry Giordano, *Operator Algebras, Ergodic Theory*

J.E. Graham, *Sampling Theory, Multivariate Analysis*

D.E. Handelman, *K-theory, Operator Algebras, Ring Theory*

Kenneth Hardy, *Computational Number Theory*

R.M. Herz-Fischler, *History and Sociology of Mathematics*

B.G. Ivanoff, *Probability, Point Processes, Martingales*

Barry Jessup, *Rational Homotopy*

Daniel Krewski, *Applied Statistics in Medicine*

E.O. Kreyszig, *Partial Differential Equations, Numerical Analysis*

L.E. May, *Numerical Analysis*

D.R. McDonald, *Applied Probability*

Paul Mandl, *Non-linear Partial Differential Equations*

Sam Melkonian, *Non-linear Differential Equations*

S.E. Mills, *Applied Statistics, Statistical Methods, Inference*

A.B. Mingarelli, *Ordinary Differential Equations, Difference Equations*

M.J. Moore, *Coding Theory*
B.C. Mortimer, *Group Theory, Coding Theory*
Erhard Neher, *Jordan Algebras, Algebraic Groups*
L.D. Nel, *Nonnormable Analysis and Calculus*
J.N. Pandey, *Generalized Functions, Partial Differential Equations*
J.C. Poland, *Group Theory*
I.S. Pressman, *Optimization, Algebra*
B.M. Puttaswamaiah, *Group Representations and Applications*
M.L. Racine, *Jordan Algebras*
Mizanur Rahman, *Special Functions*
J.N.K. Rao, *Sample Surveys Theory and Methods*
Luis Ribes, *Group Theory*
R.B. Richter, *Graph Theory, Combinatorics*
Ivan Rival, *Combinatorics, Algorithms*
Wulf Rossmann, *Lie Groups*
Damien Roy, *Transcendental Number Theory, Diophantine Approximations*
Bahman Saffari, *Analytic Number Theory*
A.K.Md.E. Saleh, *Order Statistics, Mathematical Statistics*
H.H. Schirmer, *Algebraic Topology*
P.J. Scott, *Logic, Category Theory*
Jun Shao, *Statistical Inference, Resampling Methods*
R.R. Sitter, *Surveys, Biostatistics, Resampling, Design, Quality*
Barbara Szyszkowicz, *Statistics*
B.J. Tomiuk, *Banach Algebras*
Remì Vaillancourt, *Partial Differential Equations, Numerical Methods*
K.S. Williams, *Number Theory*
B.B. Winter, *Applied Probability, Nonparametric Statistics*

Master of Science

Admission Requirements
The normal requirement for admission to the master's program is an honours bachelor's degree in mathematics, or the equivalent, with at least high honours standing. Applicants holding a general (pass) degree with at least high honours standing may be admitted to a qualifying-year program. Their subsequent admission to the regular master's program depends on their performance during the qualifying-year program and will be decided no later than one year after admission to the qualifying-year program. Details are outlined in the general section of this calendar. Students with outstanding academic performance and research promise while in the M.Sc. program may be permitted to transfer to the Ph.D. program without completing the M.Sc. program.

Program Requirements
The two options for the M.Sc. program are:
- Eight one-term courses (or equivalent) and a thesis
- Ten one-term courses (or equivalent)

The courses must be chosen from those at the graduate level except that a student may take up to two one-term approved undergraduate courses at the fourth-year level to satisfy these requirements. Not all these courses may be taken in the same field of mathematics; at least two must be in another field. All master's students are required to participate actively in a seminar or project under the guidance of his/her adviser. A maximum of two one-term courses taken outside of the Department of Mathematics and Statistics at Carleton University or the Department of Mathematics at the University of Ottawa may be allowed for credit.

Students who plan to specialize in probability and statistics are strongly advised that during their master's program they include, where possible, the courses 70.450, 70.551 in mathematical statistics; 70.452, 70.555 in applied statistics, and 70.451, 70.571 in probability, together with two further one-term courses in the Department of Mathematics and Statistics. In addition, a graduate course in another field, such as biology, bio-statistics, economics, computer science, systems analysis, and stochastic modelling, is highly recommended.

Doctor of Philosophy

Admission Requirements
The normal requirement for admission to the Ph.D. program is a master's degree in mathematics, or the equivalent, with at least high honours standing. Details are outlined in the general section of this calendar.

Program Requirements
The course requirements, which are determined at the time of admission, include a minimum of six one-term graduate courses (or equivalent) and a suitable thesis. Not all of these courses may be taken in the same field of mathematics; at least two must be in another field.

All candidates must take a comprehensive examination, and satisfy a language requirement. The language requirement is determined by the candidate's advisory committee and normally requires the ability to read mathematical literature in a language considered useful for his/her research or career, and other than the candidate's principal language of study.

Students specializing in *mathematics and probability* undertake a comprehensive examination in the following areas:

- The candidate's general area of specialization at the Ph.D. level
- Examinations on two topics chosen from algebra, analysis, probability, topology, and statistics. (This choice excludes the student's specialty.)

Students specializing in *statistics* must write an examination in the following areas:

- Mathematical statistics which includes multivariate analysis
- An examination in probability, *and*
- An examination in either i) applied statistics, or ii) in analysis

In all cases, the examination must be completed successfully within twenty months of initial registration in the Ph.D. program in the case of full-time students and within thirty-eight months of initial registration in the case of part-time students.

All Ph.D. candidates are also required to undertake a final oral examination on the subject of their thesis.

Selection of Courses

The following undergraduate courses may, with the approval of the Department of Mathematics and Statistics, be selected by master's candidates in partial fulfilment of their degree requirements:

Mathematics and Statistics

70.401	Vector Calculus
70.403	Functional Analysis
70.407	Measure Theory
70.415	Rings and Modules
70.416	Group Theory
70.417	Commutative Algebra
70.418	Homological Algebra and Category Theory
70.425	Introduction to General Topology
70.426	Introduction to Algebraic Topology
70.427	Foundations of Geometry
70.428	Introduction to Differentiable Manifolds
70.435	Analytic Number Theory
70.436	Algebraic Number Theory
70.445	Analytical Dynamics
70.446	Hydrodynamics and Elasticity
70.447	Tensor Analysis and Relativity Theory
70.450	Parametric Estimation
70.451	Probability Theory
70.452	Sampling: Theory and Methods
70.453	Applied Multivariate Analysis
70.456	Non-Parametric Methods
70.457	Statistical Inference
70.458	Stochastic Models
70.459	Stochastic Optimization
70.470	Partial Differential Equations I
70.471	Partial Differential Equations II
70.472	Integral Transforms
70.473	Qualitative Theory of Ordinary Differential Equations
70.482	Introduction to Mathematical Logic
70.483	Topics in Applied Logic
70.484	Design and Analysis of Algorithms
70.485	Theory of Automata
70.486	Numerical Analysis
70.487	Game Theory
70.488	Graph Theory and Algorithms

Graduate Courses*

- Mathematics 70.501 W1 (MAT5120)
Abstract Measure Theory
Abstract measure and integral, L-spaces, complex measures, product measures, differentiation theory, Fourier transforms.
Prerequisite: Mathematics 70.407.

- Mathematics 70.502 F1 (MAT5123)
Distributions and Generalized Functions
Linear topological spaces, countably multinormed spaces, countable union spaces and their duals, testing function spaces, spaces of generalized functions and their structure, Schwartz distributions, calculus of distribution, convolution, analytic representation, and Fourier transform of distributions.
Prerequisite: Mathematics 70.403.

- Mathematics 70.503 F1 (MAT5122)
Banach Algebras
Commutative Banach algebras; the space of maximal ideals; representation of Banach algebras as function algebras and as operator algebras; the spectrum of an element. Special types of Banach algebras; for example, regular algebras with involution, applications.

- Mathematics 70.504 F1 (MAT5129)
Integral Equations
A survey of the main results in the theory of non-singular linear integral equations; Volterra and Fredholm equations of first and second kind in the L_2 case, with special results for the continuous case; Hermitian kernels; eigen-function expansions; compact operators.
Prerequisites: Mathematics 70.302 and 70.403.

* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- Mathematics 70.505F1 (MAT5127)
Complex Analysis
Complex differentiation and integration, harmonic functions, maximum modulus principle, Runge's theorem, conformal mapping, entire and meromorphic functions, analytic continuation.

- Mathematics 70.506F1 (MAT5316)
Topological Vector Spaces
Construction of new topological vector spaces out of given ones; local convexity and the Hahn-Banach theorem; compactness and the Krein-Milman theorem; conjugate spaces, polar sets.
Prerequisite: Mathematics 70.403.

- Mathematics 70.507F1 (MAT5125)
Real Analysis I (Measure Theory and Integration)
General measure and integral, Lebesgue measure and integration on R, Fubini's theorem, Lebesgue-Radon-Nikodym theorem, absolute continuity and differentiation, LP-spaces. Selected topics such as Daniell-Stone theory.
Prerequisites: Mathematics 70.301 and 70.302 (MAT3125) or permission of the Department.

- Mathematics 70.508W1 (MAT5126)
Real Analysis II (Functional Analysis)
Banach and Hilbert spaces, bounded linear operators, dual spaces. Topics selected from: weak- and weak-topologies, Alaoglu's theorem, compact operators, differential calculus in Banach spaces, Riesz representation theorems.
Prerequisite: Mathematics 70.507 (MAT5125) or permission of the Department.

- Mathematics 70.509F1 (MAT5121)
Introduction to Hilbert Space
Geometry of Hilbert Space, spectral theory of linear operators in Hilbert Space.
Prerequisites: Mathematics 70.301, 70.302, and 70.403.

- Mathematics 70.512F1 (MAT5148)
Group Representations and Applications
An introduction to group representations and character theory, with selected applications.

- Mathematics 70.513F1 (MAT5146)
Rings and Modules
Generalizations of the Wedderburn-Artin theorem and applications, homological algebra.

- Mathematics 70.514F1 (MAT5143)
Lie Algebras
Basic concepts; ideals, homomorphisms, nilpotent, solvable, semi-simple. Representations, universal enveloping algebra. Semi-simple Lie algebras:

structure theory, classification, representation theory.
Prerequisites: Mathematics 70.517 (MAT5141) and 70.519 (MAT5142) or permission of the Department.

- Mathematics 70.516W1 (MAT5145)
Group Theory
Fundamental principles as applied to abelian, nilpotent, solvable, free, and finite groups; representations.
Prerequisite: Mathematics 70.310 or permission of the Department.

- Mathematics 70.517F1 (MAT5141)
Algebra I
Groups, Sylow subgroups, finitely generated abelian groups. Rings, field of fractions, principal ideal domains, modules. Polynomial algebra, Euclidean algorithm, unique factorization.
Prerequisite: Permission of the Department.

- Mathematics 70.518W1 (MAT5147)
Homological Algebra and Category Theory
Axioms of set theory, categories, functors, natural transformations; free, projective, injective and flat modules; tensor products and homology functors, derived functors; dimension theory.
Prerequisite: Mathematics 70.310 or permission of the Department.

- Mathematics 70.519W1 (MAT5142)
Algebra II
Field theory, algebraic and transcendental extensions, finite fields, Galois groups. Modules over principal ideal domains, decomposition of a linear transformation, Jordan normal form.
Prerequisites: Mathematics 70.517 (MAT5141) and permission of the Department.

- Mathematics 70.521W1 (MAT5150)
Topics in Geometry
Various axiom systems of geometry. Detailed examinations of at least one modern approach to foundations, with emphasis upon the connections with group theory.
Prerequisite: Permission of the Department.

- Mathematics 70.522F1 (MAT5168)
Homology Theory
The Eilenberg-Steenrod axioms and their consequences, singular homology theory, applications to topology and algebra.
Prerequisite: Mathematics 70.425.

- Mathematics 70.525F1 (MAT5151)
Topology I
Topological spaces, product and identification topologies, countability and separation axioms,

compactness, connectedness, metrization, net and filter convergence.
Prerequisite: Mathematics 70.301 or permission of the Department.

• Mathematics 70.526W1 (MAT5152)
Topology II
Homotopy, fundamental group, covering spaces, complexes, classification of two-dimensional manifolds.
Prerequisites: Mathematics 70.310 (MAT3143) and 70.525 (MAT5151) or permission of the Department.

• Mathematics 70.527F1 (MAT5169)
Foundations of Geometry
A study of at least one modern axiom system of Euclidean and non-Euclidean geometry, embedding of hyperbolic and Euclidean geometries in the projective plane, groups of motions, models of non-Euclidean geometry.
Prerequisite: Mathematics 70.310 (may be taken concurrently) or permission of the Department.

• Mathematics 70.528F1 (MAT5155)
Differentiable Manifolds
A study of differentiable manifolds from the point of view of either differential topology or differential geometry. Topics such as smooth mappings, transversality, intersection theory, vector fields on manifolds, Gaussian curvature, Riemannian manifolds, differential forms, tensors, and connections are included.
Prerequisite: Mathematics 70.301 or permission of the Department.

• Mathematics 70.531F1 (MAT5161)
Mathematical Logic
A basic graduate course in mathematical logic. Propositional and predicate logic, proof theory, Gentzen's Cut-Elimination, completeness, compactness, Henkin models, model theory, arithmetic and undecidability. Special topics (time permitting) depending on interests of instructor and audience. Honours undergraduate alegebra, analysis and topology or permission of the instructor.

• Mathematics 70.535F1 (MAT5163)
Analytic Number Theory
Dirichlet series, characters, Zeta-functions, prime number theorem, Dirichlet's theorem on primes in arithmetic progressions, binary quadratic forms.
Prerequisite: Mathematics 70.307 or permission of the Department.

• Mathematics 70.536W1 (MAT5164)
Algebraic Number Theory
Algebraic number fields, bases, algebraic integers, integral bases, arithmetic in algebraic number fields, ideal theory, class number.
Prerequisite: Mathematics 70.310 or permission of the Department.

• Mathematics 70.540F1 (MAT5185)
Advanced Classical Mechanics
Hamiltonian dynamics, integral invariants, non-holonomic systems, rigid body motions.
Prerequisite: Mathematics 70.345 or permission of the Department.

• Mathematics 70.541F1 (MAT5320)
Calculus of Variations
Extreme values of functionals; necessary conditions for an extremum. Sufficient conditions for an extremum. Hamilton-Jacobi Theory and the Maximum Principle of Pontryagin. The problem of Lagrange; the Isoperimetric problem.
Prerequisite: Mathematics 70.345 or permission of the Department.

• Mathematics 70.542W1 (MAT5186)
Special Functions
Hypergeometric and Generalized Hypergeometric functions; classical orthogonal polynomials in discrete and continuous variables. Confluent, Hypergeometric and Bessel functions. Asymptotic expansions; steepest descent, WKBJ approximation and other asymptotic methods.
Prerequisites: Mathematics 70.307 and 70.308, or permission of the Department.

• Mathematics 70.545F1 (MAT5131)
Ordinary Differential Equations
Existence and uniqueness theorems, boundary value problems, qualitative theory.
Prerequisite: Mathematics 70.308 or permission of the Department.

• Mathematics 70.546F1 (MAT5133)
Introduction to Partial Differential Equations
First order linear, quasi-linear, and nonlinear equations; second order equations in two or more variables; systems of equations; the wave equation; Laplace and Poisson equations; Dirichlet and Neumann problems; Green's functions.
Prerequisites: Mathematics 70.302, or 70.307 and 70.308, or permission of the Department.

• Mathematics 70.547W1 (MAT5134)
Topics in Partial Differential Equations
Theory of distributions, initial-value problems based on two-dimensional wave equations, Laplace

transform, Fourier integral transform, diffusion problems, Helmholtz equation with application to boundary and initial-value problems in cylindrical and spherical coordinates.
Prerequisite: Mathematics 70.546 or permission of the Department.

- Mathematics 70.550F1 (MAT5177)
Multivariate Normal Theory
Multivariate normal distribution properties, characterization, estimation of means, and covariance matrix. Regression approach to distribution theory of statistics; multivariate tests; correlations; classification of observations; Wilks' criteria.
Prerequisite: Mathematics 70.350.

- Mathematics 70.551W1 (MAT5191)
Mathematical Statistics II
Confidence intervals and pivotals; Bayesian intervals; optimal tests and Neyman-Pearson theory; likelihood ratio and score tests; significance tests; goodness-of-fit-tests; large sample theory and applications to maximum likelihood and robust estimation.
Prerequisite: Mathematics 70.450 or 70.560 or permission of the Department.

- Mathematics 70.552W1 (MAT5192)
Sampling Theory and Methods
Unequal probability sampling with and without replacement; unified theory for standard errors; prediction approach; ratio and regression estimation; stratification and optimal designs; multistage cluster sampling; double sampling; domains of study; post-stratification; nonresponse; measurement errors; related topics.
Prerequisite: Mathematics 70.452 or permission of the Department.

- Mathematics 70.553F1 (MAT5193)
Linear Models
Theory of non full rank linear models; estimable functions, best linear unbiased estimators, hypotheses testing, confidence regions; multi-way classifications; analysis of covariance; variance component models; maximum likelihood estimation, Minque, Anova methods; miscellaneous topics.
Prerequisite: Mathematics 70.450 or permission of the Department.

- Mathematics 70.554F1 (MAT5194)
Stochastic Processes and Time Series Analysis
Stationary Stochastic processes, inference for stochastic processes, applications to time series and spatial series analysis.
Prerequisite: Mathematics 70.451 or permission of the Department.

- Mathematics 70.555W1 (MAT5195)
Design of Experiments
Overview of linear model theory; orthogonality; randomized block and split plot designs; latin square designs; randomization theory; incomplete block designs; factorial experiments: confounding and fractional replication; response surface methodology. Miscellaneous topics.
Prerequisite: Mathematics 70.355 or 70.450 or permission of the Department.

- Mathematics 70.556W1 (MAT5175)
Robust Statistical Inference
Nonparametric tests for location, scale, and regression parameters; derivation of rank tests; distribution theory of linear rank statistics and their efficiency. Robust estimation of location, scale and regression parameters; Huber's M-estimators, Rank-methods, L-estimators. Influence function. Adaptive procedures.
Prerequisite: Mathematics 70.450 or permission of the Department.

- Mathematics 70.557W1 (MAT5176)
Advanced Statistical Inference
Pure significance test; uniformly most powerful unbiased and invariant tests; asymptotic comparison of tests; confidence intervals; large-sample theory of likelihood ratio and chi-square tests; likelihood inference; Bayesian inference and topics such as empirical Bayes inference; fiducial and structural methods; resampling methods.
Prerequisite: Mathematics 70.457 or 70.551 or permission of the Department.

- Mathematics 70.558F1 (MAT5172)
Topics in Stochastic Processes
Course contents will vary, but will include topics drawn from Markov processes. Brownian motion, stochastic differential equations, martingales, Markov random fields, random measures, and infinite particle systems, advanced topics in modelling, population models, etc.
Prerequisites: Mathematics 70.356 or 70.451, or permission of the Department.

- Mathematics 70.559F1 (MAT5196)
Multivariate Analysis
Multivariate methods of data analysis, including principal components, cluster analysis, factor analysis, canonical correlation, MANOVA, profile analysis, discriminant analysis, path analysis.
Prerequisite: Mathematics 70.450 or permission of the Department.

- Mathematics 70.560F1 (MAT5190)
Mathematical Statistics I
Statistical decision theory; likelihood functions; sufficiency; factorization theorem; exponential families; UMVU estimators; Fisher's information;

Cramer-Rao lower bound; maximum likelihood and moment estimation; invariant and robust point estimation; asymptotic properties; Bayesian point estimation.
Prerequisite: Mathematics 70.350 or permission of the Department.

- Mathematics 70.561F1 (MAT5197)
Stochastic Optimization
Topics chosen from stochastic dynamic programing, Markov decision processes, search theory, sequential inference problems, optimal stopping, analysis and solution of deterministic and stochastic modelling problems in the physical, social and life sciences. Students will present a paper on applications of particular interest to them.
Prerequisite: Mathematics 70.356 or permission of the Department.

- Mathematics 70.562F1 (MAT5317)
Analysis of Categorical Data
Analysis of one-way and two-way tables of nominal data; multi-dimensional contingency tables and log-linear models; tests of symmetry and marginal homogeneity in square tables; incomplete tables; tables with ordered categories; fixed margins and logistic models with binary response; measures of association and agreement; applications in biological, social and medical sciences.
Prerequisites: Mathematics 70.450, 70.457/70.551 or permission of the Department.

- Mathematics 70.563W1 (MAT5318)
Reliability and Survival Analysis
Types of censored data; nonparametric estimation of survival function; graphical procedures for model identification; parametric models and maximum likelihood estimation; exponential and Weibull regression models; nonparametric hazard function models and associate statistical inference; rank tests with censored data; engineering, medical and biological sciences applications.
Prerequisites: Mathematics 70.450, 70.457/70.551 or permission of the Department.

- Mathematics 70.565F1 (MAT5165)
Theory of Automata
Algebraic structure of sequential machines, decomposition of machines; finite automata, formal languages; complexity.
Prerequisite: Mathematics 70.210 or permission of the Department.

- Mathematics 70.567F1 (MAT5324)
Game Theory
Two-person zero-sum games; infinite games; multistage games; differential games; utility theory; two-person general-sum games; bargaining problem; n-person games; games with a continuum of players.
Prerequisite: Mathematics 70.301 or permission of the Department.

- Mathematics 70.569F1 (MAT5301)
Topics in Combinatorial Mathematics
Prerequisite: Permission of the Department.

- Mathematics 70.571W1 (MAT5198)
Stochastic Models
Markov systems, stochastic networks, queuing networks, spatial processes, approximation methods in stochastic processes and queuing theory. Applications to the modelling and analysis of computer-communications systems and other distributed networks.
Prerequisite: Mathematics 70.356 or permission of the Department.

- Mathematics 70.578F1 (MAT5170)
Probability Theory I
Probability spaces, random variables, expected values as integrals, joint distributions, independence and product measures, cumulative distribution functions and extensions of probability measures, Borel-Cantelli lemmas, convergence concepts, independent identically distributed sequences of random variables.
Prerequisites: Mathematics 70.301, 70.302 and 70.350 or permission of the Department.

- Mathematics 70.579W1 (MAT5171)
Probability Theory II
Laws of large numbers, characteristic functions, central limit theorem, conditional probabilities and expectations, basic properties and convergence theorems for martingales, introduction to Brownian motion.
Prerequisite: Mathematics 70.578 (MAT5170) or permission of the Department.

- Mathematics 70.581F1 (MAT5303)
Linear Optimization
Linear programing problems; simplex method, upper bounded variables, free variables; duality; postoptimality analysis; linear programs having special structures; integer programing problems; unimodularity; knapsack problem.
Prerequisite: Course in linear algebra and permission of the Department.

- Mathematics 70.582F1 (MAT5325)
Introduction to Information and Systems Science
An introduction to the process of applying computers in problem-solving. Emphasis is placed on the design and analysis of efficient computer algorithms for large, complex problems. Applications in a number of areas are presented: data manipulation,

databases, computer networks, queuing systems, optimization.

(Also offered as Engineering 94.582, Computer Science 95.582 and Information and Systems Science 93.582)

- Mathematics 70.583W1 (MAT5304)
Nonlinear Optimization
Methods for unconstrained and constrained optimization problems; Kuhn-Tucker conditions; penalty functions; duality; quadratic programing; geometric programing; separable programing; integer nonlinear programing; pseudo-Boolean programing; dynamic programing.
Prerequisite: Permission of the Department.

- Mathematics 70.584F1, W1, S1 (MAT5307)
Topics in Operations Research

- Mathematics 70.585F1, W1, S1 (MAT5308)
Topics in Algorithm Design

- Mathematics 70.586F1 (MAT5180)
Numerical Analysis
Error analysis for fixed and floating point arithmetic; systems of linear equations; eigen-value problems; sparse matrices; interpolation and approximation, including Fourier approximation; numerical solution of ordinary and partial differential equations.
Prerequisite: Permission of the Department.

- Mathematics 70/95.587F1 (MAT5167)
Formal Language and Syntax Analysis
Computability, unsolvable and NP-hard problems. Formal languages, classes of language automata. Principles of compiler design, syntax analysis, parsing (top-down, bottom-up), ambiguity, operator precedence, automatic construction of efficient parsers, LR, LR(O), LR(k), SLR, LL(k). Syntax directed translation.
Prerequisites: Mathematics 70.565 or 70.485 or Computer Science 95.302, or permission of the Department.

- Mathematics 70.588W1 (MAT5305)
Combinatorial Optimization
Network flow theory and related material. Topics will include shortest paths, minimum spanning trees, maximum flows, minimum cost flows. Optimal matching in bipartite graphs.
Prerequisite: Permission of the Department.

- Mathematics 70.589W1 (MAT5306)
Combinatorial Optimization
Topics include optimal matching in non-bipartite graphs, Euler tours and the Chinese Postman problem. Other extensions of network flows: dynamic flows, multicommodity flows, and flows with gains, Bottleneck problems. Matroid optimization.

Enumerative and heuristic algorithms for the Travelling Salesman and other "hard" problems.
Prerequisite: Mathematics 70.588.

- Mathematics 70.590F1, W1, S1 (MAT5990)
Seminar

- Mathematics 70.591F1, W1, S1 (MAT5991)
Directed Studies

- Mathematics 70.593F1, W1, S1
Project
This course is intended for students registered in the M.Sc. degree program in Information and Systems Science and the M.C.S. program. Students pursuing the non-thesis option will conduct a study, analysis, and/or design project under the supervision of a faculty member. Results will be given in the form of a typewritten report and presented at a departmental seminar.

- Mathematics 70.594F1, W1, S1
Statistical Internship
This course is project-oriented and affords students the opportunity to undertake statistical research and data analysis projects either within the Statistical Consulting Centre or as a cooperative project with governmental or industrial sponsors. In addition to project work, seminars on related topics will be conducted. Practical data analysis and consulting skills will be emphasized. The grade assigned in this course will be based upon oral and written presentation of analysis results and will be determined in consultation with the faculty adviser and the sponsor. Permission of the Institute is required for registration in this course.

- Mathematics 70/94/95.595F4, W4, S4
M.C.S. Thesis

- Mathematics 70/93/94/95.598 F3, W3, S3
M.Sc. Thesis in Information and Systems Science

- Mathematics 70.599F2, W2, S2
M.Sc. Thesis

- Mathematics 70.602W1 (MAT5309)
Harmonic Analysis on Groups
Transformation groups; Haar measure; unitary representations of locally compact groups; completeness and compact groups; character theory; decomposition.

- Mathematics 70.608F1, W1, S1 (MAT5326)
Topics in Analysis

- Mathematics 70.609F1, W1, S1 (MAT5329)
Topics in Analysis

- Mathematics 70.611F1, W1, S1 (MAT5327)
Topics in Algebra

- Mathematics 70.612F1, W1, S1 (MAT5330)
Topics in Algebra

- Mathematics 70.613F1, W1, S1 (MAT5331)
Topics in Algebra

- Mathematics 70.614W1 (MAT5158)
Lie Groups
Matrix groups: one-parameter groups, exponential
map, Campbell-Hausdorff formula, Lie algebra of a
matrix group, integration on matrix groups. Abstract
Lie groups.
Prerequisites: Mathematics 70.507 and 50.517 or
permission of the Department.

- Mathematics 70.621F1, W1, S1 (MAT5312)
Topics in Topology

- Mathematics 70.657F1, W1, S1 (MAT5313)
Topics in Probability and Statistics

- Mathematics 70.658F1, W1, S1 (MAT5314)
Topics in Probability and Statistics

- Mathematics 70.686F1, W1, S1 (MAT5361)
Topics in Mathematical Logic

- Mathematics 70.687F1 (MAT5162)
Mathematical Foundations of Computer Science
Foundations of functional languages, lambda calculi
(typed, polymorphically typed, untyped), Curry-
Howard Isomorphism, proofs-as-programs, normal-
ization and rewriting theory, operational semantics,
type assignment, introduction to denotational seman-
tics of programs, fixed-point programing. Topics
chosen from: denotational semantics for lambda
calculi, models of programing languages, complex-
ity theory and logic of computation, models of con-
current and distrubted systems, etc.
Prerequisites: Honours undergraduate algebra and
either topology or analysis. Some acquaintance
with logic useful, or permission of the Instructor.

- Mathematics 70.690F1, W1, S1 (MAT6990)
Seminar

- Mathematics 70.691F1, W1, S1 (MAT6991)
Directed Studies

- Mathematics 70.699F, W, S
Ph.D. Thesis

Ottawa-Carleton Institute for Physics

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UNIVERSITÉ D'OTTAWA
UNIVERSITY OF OTTAWA

CARLETON UNIVERSITY

The Institute

Director of the Institute:
Patricia Kalyniak
Associate Director:
Béla Joós

Students wishing to pursue studies in physics at the M.Sc. and Ph.D. levels in the Ottawa area do so in a cooperative program that combines the resources of the Departments of Physics of Carleton University and the University of Ottawa. The two universities have a joint committee supervising the programs, regulations and student admissions.

Students are admitted for graduate work under the general regulations of the Institute, which include criteria related to academic performance, research experience and referees' appraisals. The choice of program and/or research project and supervisor will determine the primary campus location of the student. The student's advisory committee will normally include faculty members from both universities.

The areas of physics available for programs leading to the M.Sc. or the Ph.D. degree include high energy and medical physics (Carleton), condensed matter and surface physics (Ottawa) and theoretical and nuclear physics (both campuses).

Particularly for the medical physics program, research supervision may be provided by members of other institutions in the area such as hospitals, cancer clinics and government laboratories. The list below of all members of the Institute along with their research interests can be used as a guide to possible supervisors.

Requests for information and completed applications should be sent to the director of the Institute.

Members of the Institute

M.A. Ahmed, *Particle Physics*
J.C. Armitage, *High Energy Physics, Instrumentation*
Ian Cameron, *Medical Physics*
R.K. Carnegie, *Experimental High Energy Physics*
A.L. Carter, *Intermediate Energy Physics, Instrumentation*
Sylvain Charbonneau, *Semiconductor Physics*
R.L. Clarke, *Medical Physics*
Joanna Cygler, *Medical Physics*

S.R. Das, *Semiconductor Physics*
Serge Desgreniers, *High Pressure Physics*
Marie D'Iorio, *Condensed Matter*
Madhu Dixit, *Experimental High Energy Physics*
K.W. Edwards, *Experimental High Energy Physics*
P.G. Estabrooks, *Experimental High Energy Physics*
Emery Fortin, *Semiconductor Physics*
L.H. Gerig, *Medical Physics*
Stephen Godfrey, *Theoretical Particle Physics*
C.L. Greenstock, *Medical Physics*
Francis Guillon, *Condensed Matter*
J.E. Hardy, *Field Theory*
C.K. Hargrove, *Experimental High Energy Physics*
Jacques Hébert, *High Energy Physics*
R.J. Hemingway, *Experimental High Energy Physics*
Gerhard Herzberg, *Atomic Spectroscopy*
Brian Hird, *Ion Physics*
R.J.W. Hodgson, *Theoretical Nuclear Physics*
B.J. Jarosz, *Medical Physics*
P.C. Johns, *Medical Physics*
Béla Joós, *Theoretical Condensed Matter*
Patricia Kalyniak, *Theoretical Particle Physics*
D.A. Karlen, *Experimental High Energy Physics*
Dan Kessler, *Astrophysics*
Gilles Lamarche, *Low Temperature Physics*
M.A.R. LeBlanc, *Superconductivity*
Ivan L'Heureux, *Nonequilibrium Processes in Nonlinear Systems*
B.A. Logan, *Nuclear Physics*
M.J. Losty, *Experimental High Energy Physics*
Mario Marchand, *Condensed Matter Physics*
Paul Marmet, *Atomic and Molecular Physics*
H.J.A.F. Mes, *Experimental High Energy Physics*
F.G. Oakham, *Experimental High Energy Physics*
Michael Ogg, *Experimental High Energy Physics*
Peter Piercy, *Condensed Matter Physics*
G.P. Raaphorst, *Medical Physics*
D.G. Rancourt, *Solid State Magnetism*
D.W.O. Rogers, *Medical Physics*
W.J. Romo, *Theoretical Nuclear and Particle Physics*
C.K. Ross, *Medical Physics*
Alain Roth, *Condensed Matter*
J.K. Saunders, *Medical Physics*
W.D. Sinclair, *Solar Neutrino Physics*
G.W. Slater, *Polymer Physics*
A.K.S. Song, *Theoretical Studies in Solid State*
Z.M. Stadnik, *Electronic Structure and Magnetism*
M.K. Sundaresan, *Theoretical Particle Physics*
Y.P. Varshni, *Theoretical Solid State, Astrophysics*
P.J.S. Watson, *Theoretical Particle Physics*
J.C. Woolley, *Semiconductor Physics*

Master of Science

An honours B.Sc. in Physics or a closely related field at a standard acceptable to the two universities is normally required for admission to the M.Sc. program. The admissions committee may require students to take an orientation examination during the first weeks of residence. The results of this examination may indicate the need for a student to register in undergraduate courses to fill gaps in his/her knowledge. It is strongly recommended that all students have had at least one course in computing.

Program Requirements

Normally the requirements for the M.Sc. will consist of:
- Three full lecture courses (eighteen term contact hours)
- A thesis with a weight of two full courses which will be defended at an oral examination
- Participation in the seminar series of the Institute

The minimum number of lecture courses is one and a half (nine term contact hours) of which at least one (six term contact hours) must be at the graduate level.

In special cases, the requirements may also be met by taking five full courses and no thesis. Then one of the courses must be the selected topics course 75.590T2. A comprehensive examination and participation in the seminar series will also be required.

Candidates admitted with more than the minimum lecture course requirements may be permitted to credit towards the degree a maximum of one full-course credit at the senior undergraduate level. (This maximum does not apply to qualifying-year students.)

Most incoming students will be expected to take 75.502T1.

Students in *theoretical* or *high energy physics* will normally include 75.561F1, 75.562W1, 75.571F1 and 75.572W1 among their courses.

For the *medical physics* program, the three areas of specialization are *imaging, therapy,* and *biophysics.* All students are required to take 75.523F1 and one appropriate physics half course from an area of physics other than medical physics. In addition:
- For imaging, 75.524W1 is required
- For therapy, 75.526W1 is required
- For biophysics, one half course chosen from 75.527F1, cell biology, physiology or anatomy is required

A selection from 75.528W1, 75.529F1, or, (with approval) other appropriate courses in physics, engineering, computer science, business or law can be used to complete the program.

Doctor of Philosophy

Admission Requirements

An M.Sc. in Physics or a closely related field, is normally required for admission into the Ph.D. program. Students who have been admitted to the M.Sc. program may be permitted to transfer into the Ph.D. program if they show outstanding academic performance and demonstrate significant promise for advanced research.

In exceptional cases, an outstanding student who has completed the honours B.Sc. will also be considered.

Program Requirements (from M.Sc.)

The normal requirements for the Ph.D. degree (after M.Sc.) are:
- A minimum of two full-course equivalents at the graduate level (twelve term contact hours)
- Students who lack any of the relevant courses recommended for the M.Sc. program will be expected to have completed them (or equivalents) by the end of their Ph.D. program. In addition, students in *high energy physics* or *theoretical physics* should complete 75.661 and 75.662
- A comprehensive examination with emphasis on areas chosen by the candidate's advisory committee (an oral examination and/or a written examination normally within the first full year of study)
- A thesis which will be defended at an oral examination. The examining board for all theses will include members of the Institute from both Departments of Physics. The external examiner of the thesis will be external to both Departments of Physics
- Participation in the seminar series of the Institute

Residence Requirements

For the M.Sc. degree:
- At least one year of full-time study (or the equivalent

For the Ph.D. degree (from B.Sc.):
- At least three years of full-time study (or equivalent)

For the Ph.D. degree (from M.Sc.):
- At least two years of full-time study (or equivalent)

Graduate Courses*

Some of the following are regarded as the core courses and are taught either at Carleton University or at the University of Ottawa. The more specialized courses are only taught at the indicated campus. Most of the core courses will be offered each year, but only a selection of the others. If enrolment is small, a course may be given as a reading course. In addition to the formal prerequisites for a course, any course requires permission of the Department. *The following courses may be offered either at Carleton University or the University of Ottawa.*

- Physics 75.561F1 (PHY5966)
Experimental Techniques of Nuclear and Elementary Particle Physics
The interaction of radiation and high energy particles with matter; experimental methods of detection and acceleration of particles; use of relativistic kinematics; counting statistics.
Prerequisites: Physics 75.437 and 75.477.

- Physics 75.562W1 (PHY5967)
Physics of Elementary Particles
Properties of leptons, quarks, and hadrons. The fundamental interactions. Conservation laws; invariance principles and quantum numbers. Resonances observed in hadron-hadron interactions. Three body phase space. Dalitz plot. Quark model of hadrons, mass formulae. Weak interactions; parity violation, decay of neutral kaons; CP violation; Cabibbo theory.
Prerequisite: Physics 75.477.
Also offered at the undergraduate level, with different requirements, as 75.462, for which additional credit is precluded.

- Physics 75.571F1 (PHY5170)
Intermediate Quantum Mechanics with Applications
Angular momentum and rotation operations; Wigner and Racah coefficients; several and many electron problem in atoms; variational and Hartree-Fock formalism; introduction to second quantized field theory; scattering theory.
Prerequisites: Physics 75.477 and 75.478.

- Physics 75.581F1 (PHY5140)
Methods of Theoretical Physics I
This course and Physics 75.582 are designed for students who wish to acquire a wide background of mathematical techniques. Topics can include complex variables, evaluation of integrals, approximation techniques, dispersion relations, Pade approximants, boundary value problems, Green's functions, integral equations, and group theory.

* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

The following courses are offered only at Carleton University.

- Physics 75.502T1 (PHY5344)
Computational Physics
The use and applicability of micro-, mini- and mainframe computers for solving physics problems. Introduction to computer architectures, operating systems and networks commonly encountered in physics experiments or applications. Programing techniques, use of libraries and graphics packages, with emphasis on packages in current use in major physics applications. Considerations of computer hardware, and interfacing computers to physics experiments. Statistical analysis, fitting and Monte Carlo methods with particular consideration to examples from particle physics and medical physics. Problems in numerical analysis, differential equations, integration, etc. with emphasis on methods used for solving problems from different areas of physics.
Prerequisite: Permission of the Department.
Also offered at the undergraduate level, with different requirements, as 75.487, for which additional credit is precluded.

- Physics 75.511F1 (PHY8111)
Classical Mechanics and Theory of Fields
Hamilton's principle; conservation laws; canonical transformations; Hamilton-Jacobi theory; Lagrangian formulation of classical field theory.

- Physics 75.522W1 (PHY8122)
Special Topics in Molecular Spectroscopy
Topics of current interest in molecular spectroscopy. In past years, the following areas have been covered: electronic spectra of diatomic and triatomic molecules and their interpretation using molecular orbital diagrams; Raman and resonance Raman spectroscopy; symmetry aspects of vibrational and electronic levels of ions and molecules in solids the presence of weak and strong resonant laser radiation. (Also offered as Chemistry 65.509/CHM8150)

- Physics 75.523F1 (PHY5161)
Medical Radiation Physics
Basic interaction of electromagnetic radiation with matter. Sources: X-ray, accelerators, nuclear. Charged particle interaction mechanisms, stopping powers, kerma, dose. Introduction to dosimetry. Units, measurements, dosimetry devices.
Prerequisite: Permission of the instructor.

- Physics 75.524W1 (PHY5112)
Physics of Medical Imaging
Outline of the principles of transmission X-ray imaging, computerized tomography, nuclear medicine, magnetic resonance imaging, and ultrasound. Physical descriptors of image quality,

including contrast, resolution, signal-to-noise ratio, and modulation transfer function are covered and an introduction is given to image processing.
Prerequisites: Physics 75.523 or equivalent, and one of Physics 75.424 or 75.427 or equivalent.

• Physics 75.526W1 (PHY5164)
Medical Radiotherapy Physics
Terminology and related physics concepts. Bragg-Gray, Spencer-Attix cavity theories, Fano's theorem. Dosimetry protocols, dose distribution calculations. Radiotherapy devices, hyperthermia.
Prerequisite: Physics 75.523 or equivalent.

• Physics 75.527F1 (PHY5165)
Radiobiology
Introduction to basic physics and chemistry of radiation interactions, free radicals, oxidation and reduction, G values. Subcellular and cellular effects: killing, repair, sensitization, protection. Measurement methods. Survival curve models. Tissue effects, genetic and carcinogenic effects, mutations, hazards. Cancer therapy. Radiation protection considerations.
Prerequisite: Physics 75.523 or equivalent must have been taken, or be taken concurrently.

• Physics 75.528W1 (PHY5163)
Radiation Protection
Biophysics of radiation hazards, dosimetry and instrumentation. Monitoring of sources, planning of facilities, waste management, radiation safety, public protection. Regulatory agencies.
Prerequisite: Physics 75.523 or equivalent.

• Physics 75.529F1 (PHY5166)
Medical Physics Practicum
This course provides hands-on experience with current clinical medical imaging and cancer therapy equipment, and with biophysics instrumentation. The student is expected to complete a small number of practical experimental projects during the term on topics such as magnetic resonance imaging, computed tomographic scanning, radiotherapy dosimetry, hyperthermia, biophysics, and radiation protection. The projects will be conducted at hospitals, cancer treatment facilities, and NRC laboratories in Ottawa.
Prerequisites: Physics 75.523 or equivalent. Also, as appropriate to the majority of projects undertaken, one of Physics 75.524, 75.526, or 75.527 or other biophysics courses or permission of the Department.

• Physics 75.532W1 (PHY8132)
Classical Electrodynamics
Covariant formulation of electrodynamics; Lenard-Wiechert potentials; radiation reaction; plasma physics; dispersion relations.
Prerequisite: Physics 75.437 or equivalent.

• Physics 75.564W1 (PHY8164)
Intermediate Nuclear Physics
Properties of the deuteron and the neutron-proton force. Nucleon-nucleon forces, isospin and charge independence. Nuclear models; single particle shell model, shell model with interactions, pairing, quasi-particles, collective models, deformed shell model. Scattering theory; effective range theory, partial wave analysis, phase shifts. Interpretation of n-p and p-p scattering experiments. Interaction of nucleons with electrons. Interaction of nuclei with radiation; multipole fields, transition rates, selection rules, internal conversion.
Prerequisite: Physics 75.468 or equivalent.

• Physics 75.572W1 (PHY8172)
Relativistic Quantum Mechanics
Relativistic wave equations. Expansion of S matrix in Feynman perturbation series. Feynman rules. An introduction to quantum electro-dynamics without second quantization. Gauge theories and the standard model.
Prerequisite: Physics 75.571.

• Physics 75.582W1 (PHY5141)
Methods of Theoretical Physics II
This course complements 75.581. Topics include group theory, discussion of SU_2, SU_3, and other symmetry groups. Lorentz group. Integral equations and eigenvalue problems.

• Physics 75.590T2 (PHY8290)
Selected Topics in Physics (M.Sc.)
A student may, with the permission of the Department, take more than one selected topic, in which case each full course in Physics 75.590 will be counted for credit. Not more than one selected topic may be taken for credit in any one academic year.

• Physics 75.591F1, W1, S1 (PHY8191)
Selected Topics in Physics (M.Sc.)

• Physics 75.599F, W, S (PHY7999)
M.Sc. Thesis

• Physics 75.661 (PHY8161)
Particle Physics Phenomenology
This course covers much of the basic knowledge for both experimental and theoretical particle physics. Topics may include: accelerators, properties of detectors, low energy spectroscopy, standard model, tests of QCD and introduction to grand unified models.
Prerequisite: Physics 75.562 or equivalent.

• Physics 75.662 (PHY8162)
Advanced Topics in Particle Physics Phenomenology
This course will consist of a variety of seminars and short lecture courses, and will cover topics of

immediate interest to the research program of the department.
Prerequisite: Permission of the Department.

- Physics 75.671F1 (PHY8173)
Quantum Electrodynamics
Relativistic quantum field theory; second quantization of Bose and Fermi fields; reduction and LSZ formalism; perturbation expansion and proof of renormalizability of quantum electrodynamics; calculations of radiative corrections and applications.
Prerequisites: Physics 75.511, 75.532, 75.571 and 75.572.

- Physics 75.690T1 (PHY8490)
Selected Topics in Physics (Ph.D.)

- Physics 75.691F1, W1 (PHY8391)
Selected Topics in Physics (Ph.D.)

- Physics 75.699F, W, S (PHY9999)
Ph.D. Thesis

The following courses, offered at the University of Ottawa, may be taken for credit by Carleton students.

- Physics 74.503 (PHY5342)
Computer Simulations in Physics
A course aimed at exploring physics with a computer in situations where analytic methods fail. Numerical solutions of Newton's equations, non-linear dynamics. Molecular dynamics simulations. Monte-Carlo simulations in statistical physics: the Ising model, percolation, crystal growth models. Symbolic computation in classical and quantum physics. Cannot be combined for credit with 75.502 (PHY5344).
Prerequisites: PHY3355 (PHY3755), PHY3370 (PHY3770), and familiarity with FORTRAN, Pascal or C.

- Physics 74.512 (PHY4361)
Nonlinear Dynamics in the Natural Sciences
A multidisciplinary introduction to nonlinear dynamics with emphasis on the techniques of analysis of the dynamic behaviour of physical systems. The course will be organized in two parts. Part I will deal with the basic mathematical concepts underlying nonlinear dynamics, including differential and difference equations, Fourier series and data analysis, stability analysis, Poincaré maps, local bifurcations, routes to chaos and statistical properties of strange attractors. Part II will involve applications of these concepts to specific problems in the natural sciences such as condensed matter physics, molecular physics, fluid mechanics, dissipative structures, evolutionary systems, etc.

- Physics 74.541F1 (PHY5100)
Solid State Physics I
Periodic structures, Lattice waves. Electron states. Static properties of solids. Electron-electron interaction. Dynamics of electrons. Transport properties. Optical properties.

- Physics 74.542 (PHY5110)
Solid State Physics II
Elements of group theory. Band structure, tight binding and other approximations, Hartree-Fock theory. Measuring the Fermi surface. Boltzmann equation and semiconductors. Diamagnetism, paramagnetism and magnetic ordering. Superconductivity.

- Physics 74.543 (PHY5151)
Type I and II Superconductors
Flux flow and flux cutting phenomena. Clem general critical state model. Flux quantization, Abrikosov vortex model and Ginzburg-Landau theory. Superconducting tunnelling junctions (Giaevar and Josephson types).
Prerequisite: PHY4370.

- Physics 74.544 (PHY6371)
Topics in Mössbauer Spectroscopy
Experimental techniques used to measure Mössbauer spectra. Physics of the Mössbauer effect: recoilless emission/absorption, anisotropic Debye-Waller factors, second order Doppler shifts, etc. Mössbauer lineshape theory with static and dynamic hyperfine interactions. Distributions of static hyperfine parameters. Physics of the hyperfine parameters: origin of the hyperfine field, calculations of electric field gradients, etc. Applications of Mössbauer spectroscopy to various areas of solid state physics and materials science.

- Physics 74.547 (PHY5380)
Semiconductor Physics I
Brillouin zones and band theory. E-k diagram, effective mass tensors, etc. Electrical properties of semiconductors. Conduction, hall effect, magneto-resistance. Scattering processes. Multivalley models and non-parabolic bands.
Prerequisite: PHY4380 or equivalent.

- Physics 74.548 (PHY5381)
Semiconductor Physics II — Optical Properties
Optical constants and dispersion theory. Optical absorption, reflection and band structure. Absorption at band edge and excitons. Lattice, defect and free carrier absorption, Magneto-optics. Photo-electronic properties, luminescence, detector theory. Experimental methods.
Prerequisite: PHY4380 or equivalent.

- Physics 74.549 (PHY5951)
Low Temperature Physics II
Helium 3 and Helium 4 cryostats. Dilution refrigerators. Theory and techniques of adiabatic demagnetization. Thermometry at low temperatures. Problems of thermal equilibrium and of thermal isolation. Properties of matter at very low temperature.
Prerequisite: PHY4355 or equivalent.

- Physics 74.551 (PHY5125)
Charged Particle Dynamics
A course on the acceleration, transport and focusing of charged particles in vacuum using electric magnetic fields. Beam optics. Phase space of an assembly of particles. Applications to experimental systems.

- Physics 74.555 (PHY5355)
Statistical Mechanics
Ensemble Theory. Interacting classical and quantum systems. Phase transitions and critical phenomena. Fluctuations and linear response theory. Kinetic equations.
Prerequisites: PHY4370 and PHY3355.

- Physics 74.556 (PHY5742)
Simulations Numériques en Physique
Un cours ayant pour but d'étudier la physique à l'aide d'un ordinateur dans des situations où les méthodes analytiques sont inadéquates. Solutions numériques des équations de Newton. Dynamique non-linéaire. Simulations de dynamique moléculaire. Simulations Monte-Carlo en physique statistique: modèle d'Ising, percolation, croissance critalline. Calcul symbolique en physique classique et quantique.
Ce cours exclut les crédits de 75.502(PHY5344)
Préalables: PHY3755 (PHY3355), PHY3770 (PHY3770) et connaissance d'un des langages FORTRAN, Pascal ou C.

- Physics 74.557 (PHY5922)
Advanced Magnetism
Study of some of the experimental and theoretical aspects of magnetic phenomena found in ferro-, ferri-, antiferro-magnetic and spin glass materials. Topics of current interest in magnetism.
Prerequisite: PHY4385 or equivalent.

- Physics 74.558 (PHY5320)
Introduction to the Physics of Macromolecules
The chemistry of macromolecules and polymers; random walks and the static properties of polymers; experimental methods; the Rouse model and single chain dynamics; polymer melts and viscoelasticity; the Flory-Huggins theory; the reptation theory; computer simulation algorithms; biopolymers and copolymers.

- Physics 74.559 (PHY5347)
Physics, Chemistry and Characterization of Mineral Systems
The materials science of mineral systems such as the network and layered silicates. In-depth study of the relations between mineralogically relevant variables such as: atomic structure, crystal chemistry, site populations, valence state populations, crystallization conditions, etc. Interpretation and basic understanding of key characterization tools such as: microprobe analysis, Mössbauer spectroscopy, X-ray diffraction and optical spectroscopy.

- Physics 74.563 (PHY5310)
Ion Collisions in Solids
Energy loss of energetic particles in passing through solids. Stopping cross sections. The influence of crystal lattice on nuclear stopping. Crystal lattice effects at high energies. Channelling and blocking. The collision cascade. Charge states of fast ions in solids from thin foil and X-ray measurements.

- Physics 74.573 (PHY6170)
Advanced Quantum Mechanics II
Systems of identical particles and many-body theory. Lattice and impurity scattering. Quantum processes in a magnetic field. Radiative and non-radiative transitions. Introduction to relativistic quantum mechanics.
Prerequisite: PHY5170 or equivalent.

- Physics 74.646 (PHY6382)
Physics of Semiconductor Superlattices
Fundamental physics of two-dimensional quantized semiconductor structures. Electronic and optical properties of superlattices and quantum wells. Optical and electronic applications. This course is intended for students registered for the Ph.D. in semiconductor physics research.
*Prerequisite:* Advanced undergraduate or graduate course in solid state physics.

- Physics 74.647 (PHY6782)
Physique des super-réseaux à semiconducteurs
Physique fondamentale des structures quantiques bi-dimensionnelles à semiconducteurs. Propriétés électroniques et optiques des super-réseaux et puits quantiques. Applications à l'électronique et à l'optique. Ce cours est destiné aux étudiants et aux étudiantes inscrits au doctorat en physique des semiconducteurs.
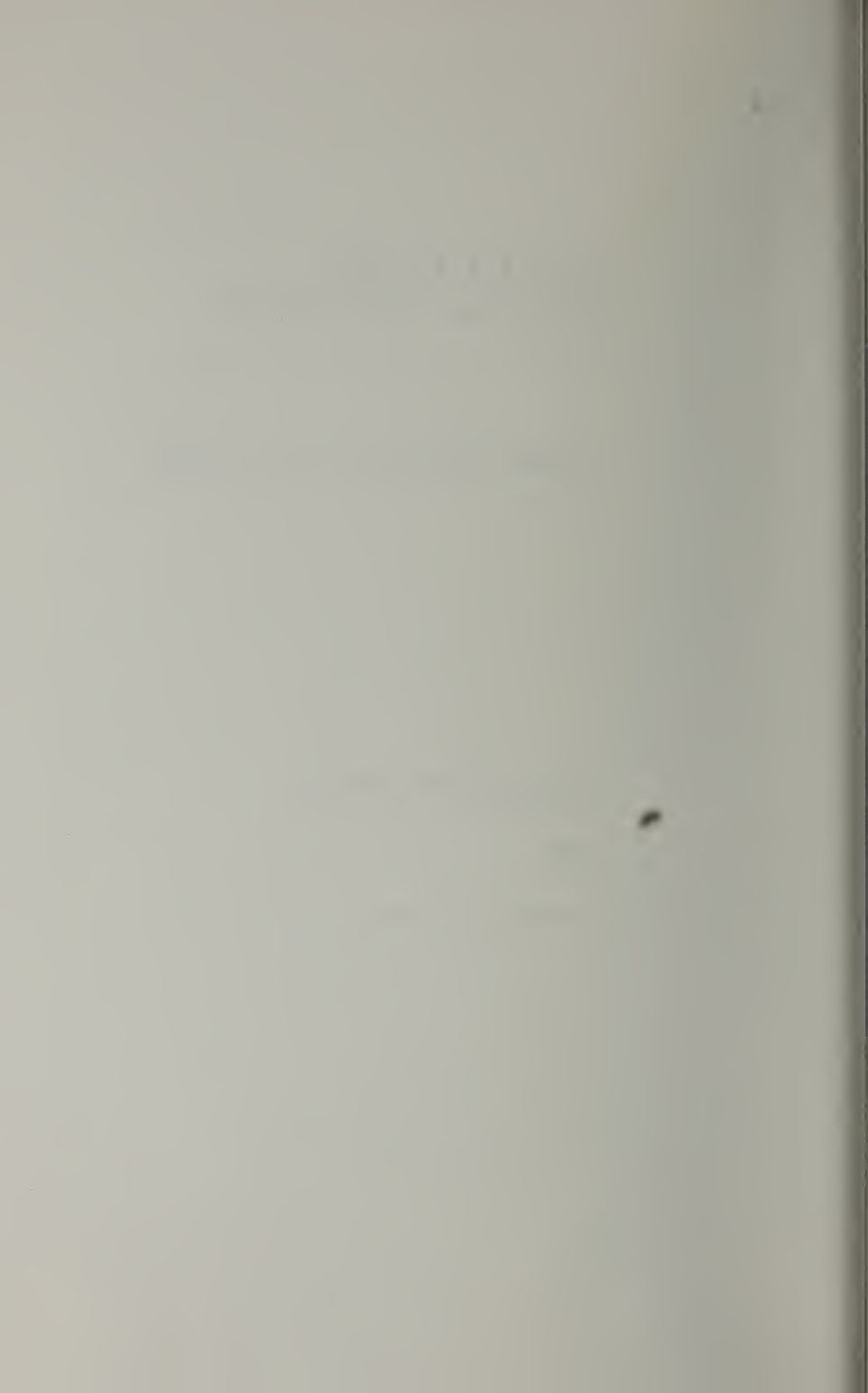*Préalable:* Cours sénior ou diplômé en physique de l'état solide.
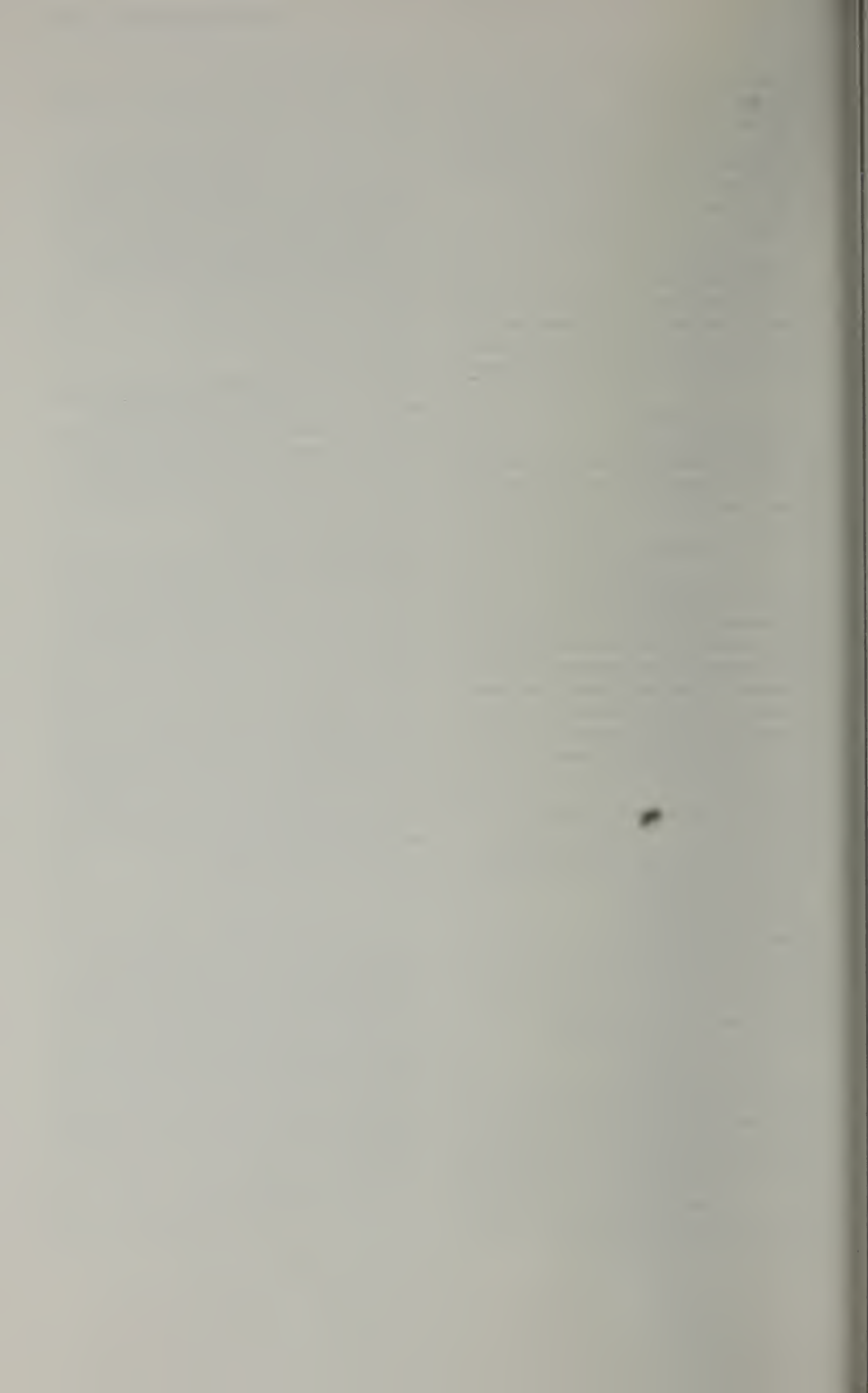
FACULTY OF SOCIAL SCIENCES

Dean Marilyn Marshall

Program Descriptions

and

Details of Courses

School of Business

Dunton Tower 1209
Telephone: 788-2388
Fax: 788-4427

The Department

Director of the School:
Nicolas Papadopoulos
Supervisor of Graduate Studies:
Judith Marshall

The School of Business offers a program of study
and research leading to a Master of Management
Studies degree.

The focus of the M.M.S. program is applied research
directed toward the management of technology, pro-
ductivity and innovation. The program of studies
will develop in students the conceptual and method-
ological skills required to manage, plan, develop
and implement technological capabilities for the
purpose of attaining the strategic and operational
goals of organizations.

The main areas of specialization within the program
are:
- Business Information Systems
- Finance
- International Business
- Management
- Marketing
- Production and Operations
- Research and Development Administration
Graduate students in the School of Business are
governed by the section of this calendar entitled
General Regulations, and by the regulations stated
in that section.

Master of Management Studies

Admission Requirements
Admission into the program is judged primarily on
the applicant's ability to undertake successfully
advanced studies and research in business, his/her
prospects for completion of the program, experi-
ence, and achievement.

Applicants are required to have the equivalent of
an honours bachelor's degree, with a minimum of
high honours standing. Applicants are expected to
have had credits in mathematics and the following
core courses in functional areas of business described
below or their equivalents:

- Business 42.210*: Management and
  Organizational Behaviour
- Business 42.228*: Introduction to Marketing
- Business 42.230*: Introduction to Management
  Science
- Business 42.240*: Business Information Systems
- Business 42.250*: Introduction to Business
  Finance
- Economics 43.220: Statistical Methods in the
  Social Sciences

In addition, applicants are expected to have had an
upper-level course sequence in their proposed area
of business specialization, and to have an adequate
grounding in at least one supporting fundamental
discipline such as economics, psychology, sociology,
mathematics, anthropology or computer science.

The School requires that all applicants submit
scores obtained in the Graduate Management
Admission Test offered by the Educational Testing
Services of Princeton, New Jersey. A superior
GMAT score will be required for admission. All
applicants whose native tongue is not English must
take the TOEFL test and obtain a minimum score of
550.

The School's admission policy is governed by the
availability of graduate student space. Possession of
the minimum admission requirements does not, in
itself, guarantee acceptance. Advanced standing
may be granted for required courses only if previous
work is judged to be equivalent to courses required
in the program. Advanced standing and transfer of
credit must be determined on an individual basis in
consultation with the supervisor of graduate studies
and must also be approved at the time of admission
by the Dean of the Faculty of Graduate Studies and
Research. In general, a grade of B− or better is
required in equivalent courses to obtain advanced
standing.

Program Requirements
The requirement for the Master of Management
Studies degree is the equivalent of five full courses
of which at least four must be at the 500 level or
above. Students must complete one and one-half
full-course credits of required business courses, one
full-course credit from a selection of advanced semi-
nars, one full-course credit of approved options and
a thesis equivalent to one and one-half full-course
credits as indicated below.

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* At the undergraduate level, denotes a half-credit course.

All master's students are required to complete:

Required Business Courses
- Business 42.592: Business Research Methods
- Business 42.595: Directed Research in Business Studies
- Business 42.597: M.M.S. Thesis Tutorial

Advanced Seminars
One full-course credit from the following list of half courses:
- Business 42.510: Seminar in Management and Administration
- Business 42.520: Seminar in Marketing
- Business 42.530: Managing the Multinational Enterprise
- Business 42.540: Seminar in Information Systems Management
- Business 42.550: Seminar in Finance
- Business 42.560: Production and Operations Management
- Business 42.570: Management of Research and Development

Approved Options
The equivalent of one full-course credit of approved courses which may be selected from among those offered by the School and in related disciplines.

Thesis
- Business 42.599 M.M.S. Thesis
The M.M.S. thesis is equivalent to one and one-half full-course credits. The thesis would normally relate to issues that are relevant to producers and users of technology.

The thesis must represent the result of the candidate's independent research undertaken after being admitted to graduate studies at Carleton University's School of Business. Previous work of the candidate may be used only as introductory or background material for the thesis.

A candidate may carry on research work related to the thesis off campus provided that the work is approved in advance and arrangements have been made for regular supervision of thesis research activities with the School's supervisor of graduate studies.

All students require the School's approval for their proposed thesis topic. Each candidate submitting a thesis will be required to take an oral examination on the subject of the thesis.

Academic Standing
A grade of B− or better must normally be obtained in each course counted towards the degree. A candidate may, with the recommendation of the School and the approval of the Dean of the Faculty of Graduate Studies and Research, be allowed a grade of C+ in one full course or each of two half courses.

Graduate Courses*

Enrolment in graduate courses requires the permission of the School through the supervisor of graduate studies.

- Business 42.510F1
Seminar in Management and Administration
A critical examination of research on decision-making and problem-solving behaviour in organizations. Particular attention will be given to the use of information and management techniques for decision making in technology-driven organizations, and to management strategies of problem solving in unpredictable circumstances.

- Business 42.511W1
Seminar in Organizational Design
This course examines alternative concepts and forms of organizational design at both the administrative and operational levels. The emphasis will be on a critical analysis of design implications of high rates of environmental and technological change. Management structures, processes and technologies, which enhance productivity and innovation will be evaluated with special reference to comparisons between Canada and other industrialized countries.

- Business 42.520F1
Seminar in Marketing
This course examines issues in productivity and innovation as they relate to marketing. The course assumes the viewpoint of product portfolio management, and addresses problems such as market assessment, marketing audits and policy, new products, existing product management, and product line profitability. Particular emphasis is placed on marketing of technology-based products and the effect of technological developments on marketing practices.

- Business 42.521W1
Contemporary Marketing Thought
This course examines the state of the art in marketing thought, and prepares the student to cope with an ever changing environment. Topics include the development of paradigms in marketing, recent advances in consumer behaviour, the acquisition of data and information from the external environment, the influence of societal and environmental developments upon marketing, and new directions in marketing theory and practice.

* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• Business 42.530F1
Managing the Multinational Enterprise
This course examines issues in the management of
multinational enterprises, e.g. optimizing productiv-
ity in multi-site environments, the dispersion of
innovative products and ideas across national
boundaries, and the management of cultural differ-
ences and their impact on the basic managerial func-
tions of communication, planning, decision making
and integration. The course will examine both
Canadian-based multinational firms and externally-
based firms with interests in Canada.

• Business 42.531W1
Seminar in International Business Management
This course examines specific topics in the area of
international business management. Areas of inter-
est include management in inter-cultural environment,
issues in international financing, and business nego-
tiations, international inter-firm alliances including
joint ventures, etc. Students will be expected to
make significant contribution to the discussion.

• Business 42.540F1
Seminar in Information Systems Management
This course is concerned with major issues in the
managing of information technology. It covers the
following major topics: organization of information
services; planning, management and administration
of information resources; assimilation and diffusion
of information technology; integration of information
services; and current opportunities and concerns in
information services. The implications of these issues
for managers are examined by the use of cases and
projects.

• Business 42.541W1
Current Topics in Business Information Systems
This course examines trends and issues associated
with business information systems within organiza-
tions. It covers topics such as analysis and design of
information systems, end-user computing, databases,
distributed systems, teleprocessing, office automation,
data communications. Other topics may include
modern technologies such as knowledge-based
systems and artificial intelligence.

• Business 42.550F1
Seminar in Finance
An analysis of contemporary theory of finance.
This analysis includes: the examination of innova-
tions in corporate financing; financial planning;
financing strategies; valuation of contingent claims;
implications of agency theory, etc. Particular empha-
sis is placed on financial decision of technology-
based firms.

• Business 42.551W1
Seminar in Financial Research
This course examines research and empirical issues
in investments, portfolio management, corporate
finance, and capital markets. Particular emphasis
will be placed on innovative research methods and
financial innovations.

• Business 42.560F1
Production and Operations Management
This is an introduction to the philosophies, methods
and techniques of modern production and operations
management. It discusses long run design issues
involving products, plants, equipment, layout, work
organization, and their interrelations. It also looks
into medium and short term operational questions
involving the planning and control of production,
inventories and product quality. The theoretical
material will be grounded in problems, cases and
project work.
Prerequisite: Graduate standing with 42.337* or
equivalent.

• Business 42.561W1
Strategic Management of Manufacturing
Technology and Productivity
This is a case-analysis course intended for students
interested in strategy, productivity, and technology
in manufacturing operations. The course focuses on
articulating and executing the manufacturing strate-
gies related to structural kinds of changes in facilities,
locations, production technologies, and sourcing
arrangements and the infrastructural kinds of
changes, in management policies and practices.
Other topics include adoption and implementation
of new technologies and interaction between research
and development, engineering and operations.
Prerequisite: Graduate standing with 42.337* or
equivalent.

• Business 42.570F1
Management of Research and Development
Examines the mission of research and development
and the management of research and development
groups. The focus is on the creation of technology
and its deployment. Topics include specific manage-
rial problems around the management of design and
development activities and the basic and applied
research which support these activities.
Prerequisite: Graduate standing with 42.337* or
equivalent.

• Business 42.571W1
Seminar in Research and Development and
Innovation Diffusion
The course deals with the concepts, theories and
methods of efficiently managing the technological
innovation cycle, the innovation monitoring system

incorporating the critical factors that signal the possible success or failure of a developing project, theories of adoption of an innovation in a firm, and the models of the diffusion of an innovation. Other topics relevant to research and development and innovation diffusion include the role technology monitoring and forecasting play in long-range planning decisions and the methodologies to perform these activities, transfer of technology, and the role of government supporting the innovation.

• Business 42.590T1 or T2
Tutorials/Directed Studies in Business
Tutorials or directed readings in selected areas of business, involving presentation of papers as the basis for discussion with the tutor. A requirement for the course may be participation in an advanced business course at the undergraduate level.

• Business 42.592F1
Business Research Methods
A consideration of the basic issues of scientific research as applied to business problems. The course includes a discussion of the logic of scientific research, proof and verification, hypothesis testing, the logic of statistical inference, and research design.

• Business 42.595F1
Directed Research in Business Studies
This course focuses on the integration of technology and strategy, the designing of a technological strategy, the development of new products and new businesses, and the design and management of innovative systems.

• Business 42.597W1, S1
M.M.S. Thesis Tutorial
A seminar designed to help the student formulate and evaluate specific research topics. The successful submission of a thesis proposal is necessary for the completion of the course.

• Business 42.599F3, W3, S3
M.M.S. Thesis Research
Prerequisite: Business 42.597.

Institute of Central/East European and Russian-Area Studies (CERAS)

Paterson Hall 457
Telephone: 788-2888
Fax: 786-7501

The Institute

Director:
Joan DeBardeleben

An interdepartmental committee was formed in 1963 to foster teaching, research, conferences, and publications in Soviet and East European studies at Carleton. In 1970, a separate department — the Institute of Soviet and East European Studies — was established to administer the interdisciplinary programs developed by the committee. Following the collapse of the Soviet Union at the end of 1991, ISEES was renamed the Institute of Central/East European and Russian-Area Studies, to reflect the changing political reality in the region. Faculty members from ten disciplines (art history, business, economics, geography, history, international affairs, law, political science, Russian, and sociology), participate regularly in the institute's activities. They are joined on an occasional basis by visiting scholars from outside the University, including invited specialists from Eastern and Central Europe and the successor states to the USSR.

In recent years the Central and East European countries and the former Soviet republics have been in the midst of a transition from one type of socio-economic and political system to another, although they are still linked with each other by earlier historical experience, the common legacy of Soviet-style communism, and by a set of similar problems resulting from that legacy. Since the collapse of the Soviet Union, the field of study remains unified by a concern with understanding the nature of the transitional processes affecting the region, in their multiple social, cultural, economic and political dimensions. Among special themes addressed in Institute courses are the following: the study of the attempted transitions to market economic systems, legal reconstructions, prospects for and problems of democratization, nationalism and ethnic conflict, national and regional integration, institution-building, problems of ethnic minorities, transformations of the social structure, changes in the international security system, environmental problems and policies, and the evolution of East-West relationships. At the undergraduate level, the Institute offers an interdisciplinary B.A. honours program in the field. The Institute also administers a program of studies leading to a Master of Arts degree in Central/East European and Russian-Area Studies, the first of its kind in Canada. The curricula for both programs are offered largely through participating departments. The M.A. program is designed for students wishing to acquire specialized knowledge of the region, including proficiency in the use of Russian as a research tool; the approach is interdisciplinary with emphasis on the social sciences and history. Students may take advantage of the university's regular academic exchanges with post-secondary institutions in Hungary, Poland, and Russia.

Qualifying-Year Program

Applicants who have a general (pass) bachelor's degree in one of the disciplines represented in the program, or who lack sufficient area studies or language training may be admitted to a qualifying-year program designed to raise their status to that of honours graduates in East European Studies. Students are expected to achieve high honours standing in qualifying-year courses in order to qualify for admission to the master's year.

To be eligible for admission to the qualifying-year program, an applicant must already have taken some courses in the area of East European Studies, so that by the end of the program he or she will have satisfied the basic requirements for admission to the master's program. All students are normally required to have completed the equivalent of an introductory course in Russian upon entry into the Qualifying-Year program.

Master of Arts

Admission Requirements

The normal requirement for admission to the master's program is an honours degree (or the equivalent) with at least high honours standing dealing with East European Studies.

Honours graduates in other disciplines are eligible for admission provided they meet the following requirements:

- A total of seven full courses (or the equivalent) in the field should have been taken in no fewer than three different departments (excluding Russian language courses)
- At least high honours standing
- A reading knowledge of Russian (normally at a minimum, equivalent to two academic years of Russian instruction, or one year with an intensive summer program).

Program Requirements

The specific requirements in the master's programs are the following:
- East European Studies 55.500 and 55.501, two half-course seminars in Central/East European and Russian-Area Studies, offered specially by the Institute, and incorporating the approaches of several relevant disciplines
- Two full courses, or the equivalent, chosen with the approval of the graduate supervisor from the list below with at least one full course (or the equivalent) at the 500 level. No more than one full credit maybe taken at the 400 level. No more than one half credit may be taken in the Department of Russian.
- One of the following:

East European Studies 55.598, a research essay incorporating the approaches of at least two of the disciplines represented in the program; the research essay must be combined with an additional full course, or the equivalent, chosen from those listed below (not including Russian) and must be defended orally

or

East European Studies 55.599, an M.A. thesis which must combine the interdisciplinary approach with a greater degree of originality than that required of the research essay, and which must be defended orally

In both cases (55.598, 55.599) the paper should demonstrate that its author is capable of undertaking research in Russian, or in another language used in the region. The 55.599 option cannot be taken without the specific permission of the graduate supervisor.

- Each student must demonstrate proficiency in Russian or in another of the region's languages (with approval of the graduate supervisor), by passing a written translation examination. A list of languages which may be selected to meet this requirement is available from the Institute. If a language other than Russian is selected, this language must be utilized in undertaking research for the research

essay or M.A. thesis. Language courses needed to enable a student to pass the language examination cannot be used to fulfil the minimum M.A. course requirements described above.

Students are advised to consult with the relevant departments for final course listings for 1994-95, as changes in curricula may be made too late for inclusion; in the calendar some of the courses are not offered every year. Undergraduate courses below the 400 level may be taken by qualifying-year students, and by students in the M.A. program as supplementary to the minimum M.A. requirements. (See the program description for the Institute in the *Undergraduate Calendar*.)

Art History
11.422 Topics in Eastern Medieval Art

Economics
43.486 Comparative Economic Systems I
43.487 Comparative Economic Systems II
43.586 Comparative Economic Systems I
43.587 Comparative Economic Systems II

History
24.460 Selected Problems in Russian History
24.461 Selected Problems in Soviet History
24.560 Revolutionary Russia, 1898-1921
24.580 Problems in International History

International Affairs
46.522 International Security After the Cold War
46.538 International Economics
46.582 The Political Economy of East-West Relations
46.584 International Relations in Europe

Law
51.488 Socialist Legal Systems

Political Science
47.431 Marxist Thought
47.432 Contemporary Marxism
47.461 Foreign Policies of Soviet Successor States
47.514 The Transition from Communism
47.515 Post-Communist Politics in East Central Europe
47.516 Selected Problems in the Politics of Soviet Successor States
47.586 Strategic Thought and Issues in International Security

Russian
36.420 Russian for International Relations I
36.421 Russian for International Relations II

Sociology
53.584 Modern Marxist Theory

East European Studies

55.400	Modern Polish Society
55.401	Nationalism and Ethnic Conflict in Eastern and Central Europe
55.402	Development of the Russian North
55.403	Soviet and Russian Military History and Affairs
55.404	National Tensions in the Soviet Successor States
55.405	Environmental Problems and Politics in East Central Europe and Eurasia
55.406	The Business Environment in East Central Europe and the Soviet Successor States
55.407	Social and Political Discourse in Russia
55.500	Interdisciplinary Seminar I
55.501	Interdisciplinary Seminar II
55.502	State-Society Relations in Transition
55.507	Social and Political Discourse in Russia
55.590	Tutorial in Central/East European and Russian-Area Studies
55.591	Tutorial in Central/East European and Russian-Area Studies
55.592	Tutorial in Central/East European and Russian-Area Studies
55.593	Tutorial in Central/East European and Russian-Area Studies
55.594	Tutorial in Central/East European and Russian-Area Studies
55.595	Tutorial in Central/East European and Russian-Area Studies
55.596	Tutorial in Central/East European and Russian-Area Studies

Other 400 and 500 level courses may be approved by graduate advisers as Institute of Central/East European and Russian-Area Studies credits if they are deemed appropriate to a particular student's objectives.

Academic Standing

Master's candidates must obtain a grade of minimum B– on all work credited towards the degree.

Graduate Courses*

• East European Studies 55.500F1
Interdisciplinary Seminar I
The theme of the seminar varies from year to year, but the continuing objective is to apply the approaches and methods of several relevant disciplines to selected themes and countries.

* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• East European Studies 55.501W1
Interdisciplinary Seminar II
Students should normally complete 55.500F1 before enrolling in this course. In addition to continued discussion of approaches and methods of several relevant disciplines, students will begin preparatory work on their Master's research essays or theses.

• East European Studies 55.502F1 or W1
State-Society Relations in Transition
This seminar addresses the relationship between social forces and state structures at both the national and local levels in the USSR, in its successor states, and/or in other Central/East European states.
Prerequisite: Approval of the Institute, with appropriate facility in the Russian language.

• East European Studies 55.507W1
Social and Political Discourse in Russia
This seminar will involve analysis of materials from the Russian-language media dealing with contemporary social and political issues. Most course readings will be in the Russian language. Lectures and at least a portion of seminar discussion will be in Russian.
Prerequisite: Approval of the Institute, with appropriate facility in the Russian language.

• East European Studies 55.590F1
Tutorial in Russian-Area Studies
A course of directed readings on selected aspects of the Soviet successor states, involving preparation of papers as the basis for discussion with the tutor. Offered when no regular course offering meets a candidate's specific needs.

• East European Studies 55.591W1
Tutorial in Russian-Area Studies

• East European Studies 55.592S1
Tutorial in Russian-Area Studies

• East European Studies 55.593F1
Tutorial in Central and East European Studies
A course of directed readings on selected aspects of Eastern and Central Europe, involving preparation of papers as the basis for discussion with the tutor. Offered when no regular course offering meets a candidate's specific needs.

• East European Studies 55.594W1
Tutorial in Central and East European and Russian-Area Studies

• East European Studies 55.595S1
Tutorial in Central/East European and Russian-Area Studies

• East European Studies 55.596T2
Tutorial in Central/East European and Russian-Area Studies

- East European Studies 55.598F2, W2, S2
Research Essay
A research essay on some topic relating to the
Central/East European and Russian-Area Studies

- East European Studies 55.599F4, W4, S4
M.A. Thesis
Other courses may be available at the University of
Ottawa.

Department of Economics

Loeb Building C877
Telephone: 788-3744
Fax: 788-3906

The Department

Chair of the Department:
S.B. Park
Supervisor of M.A. Studies:
To be announced
Supervisor of Ph.D. Studies:
M.S. Demers
Director of Joint Doctoral Program with the University of Ottawa:
Gilles Grenier

The Department of Economics offers programs of study and research leading to the M.A. and Ph.D. degrees.

Graduate students in economics undertake a thorough review of economic theory, together with an analysis of the Canadian economy, its institutions and history, and the working of public policy. Stress is placed on the understanding and application of quantitative methods to all aspects of economics. Although the programs are generally oriented towards policy problems, there is considerable opportunity for the development of specialized interests.

The main areas of specialization within the department include the following:
• Industrial Organization
• Public Economics
• Monetary Economics
• International Trade
• Economic Theory
• Quantitative Methods

Qualifying-Year Program

Applicants who have a general (pass) bachelor's degree, or who otherwise lack the required undergraduate preparation, may be admitted to a qualifying-year program designed to raise their standing to honours status. If successful, they may be permitted to proceed to the master's program the following year.

Refer to the general section of this calendar for details of the regulations governing the qualifying year.

Master of Arts

Admission Requirements

The normal requirement for admission to the master's program is an Ontario honours B.A. (or the equivalent) in Economics, with at least high honours standing.

Applicants are expected to have had adequate preparation in microeconomic and macroeconomic theory, econometrics, and mathematics. This could be satisfied, for example, by the following four undergraduate courses: advanced microeconomic theory, advanced macroeconomic theory, econometrics, and mathematics for economists. Students with deficiencies in these requirements may have their program requirements extended accordingly.

The department may require certain applicants to write the Graduate Record Examination Aptitude Test and the Advanced Test in Economics offered by the Educational Testing Service.

Program Requirements

All master's students in economics are required to complete the following courses:

Economics
43.501   Microeconomic Theory I
43.502   Macroeconomic Theory I
43.503   Microeconomic Theory II
43.504   Macroeconomic Theory II
43.505   Econometrics I
In addition, each candidate must select and complete one of the following:
• A thesis, equivalent to one and one-half credits and approved course(s) for one credit
• Approved courses for two and one-half credits, one of which may be selected from among those offered in a related discipline, with permission of the Department, through the supervisor of M.A. studies
Economics 43.593: Mathematical Methods for Economists is strongly recommended.

Academic Standing

A grade of B− or better must normally be received in each course counted towards the master's degree. With respect to the required courses in the program there will be *no* exceptions. A candidate may, with the recommendation of the department and the approval of the Dean of the Faculty of Graduate

Studies and Research, be allowed a grade of C+ in one full or each of two half non-required courses.

Doctor of Philosophy

The doctoral program is offered jointly by the Departments of Economics at Carleton University and the University of Ottawa.

The Ph.D program stresses the application of economic theory to the analysis of Canadian economic policy and economic development. Five areas of specialization are available for intensive study and thesis research: public economics, industrial organization, monetary economics, international economics, and economic development. The program of courses and thesis guidance, drawing upon the faculty of the two departments, will encompass course requirements, policy-oriented workshops, comprehensive examinations, and a thesis. Students are expected to have, or to acquire, proficiency in mathematics and statistics before proceeding with the program.

While satisfying the course requirements, a student must be enrolled on a full-time basis for three consecutive terms.

Admission Requirements
The normal requirement for admission into the Ph.D. program is a master's degree (or the equivalent) from a recognized university, with high honours standing. The department may require certain applicants to write the Graduate Record Examination Aptitude Test and the Advanced Test in Economics offered by the Educational Testing Service.

Transfer from Master's to Ph.D. Program
A student who shows outstanding academic performance, and who demonstrates high promise for advanced research during the master's program may, subject to meeting the requirements below, be permitted to transfer into the Ph.D. program without completing the M.A. program
- The student will have completed Economics 43.501, 43.502, 43.505, plus an additional four half courses at the graduate level
- The student must make formal application to the graduate studies committee at least one month before the beginning of the term in which he/she wishes to begin the Ph.D. program
- Students permitted to transfer into the Ph.D. program will be required to complete the equivalent of eleven and one-half courses

Program Requirements
Students admitted to the joint Ph.D program are required to complete three compulsory half courses: microeconomic theory, macroeconomic theory, and advanced econometrics.

Students are also required to do course work in two of five fields of specialization leading to field comprehensive exams and the writing of a thesis. To fulfil this requirement, students are expected to assimilate the material in three half courses in each of two fields of specialization. However, the department expects that a typical entering student with a completed M.A. will have taken the equivalent of three of these half courses during his or her M.A. course work. If an entering student meets this expectation, the student is required to take only three half courses over two fields of specialization. If the student's background is not consistent with this expectation, the admissions committee may require, as a condition of entry, that a student take up to three additional half courses. Courses in the fields of specialization will be:

Public Economics
- Public Economics: Expenditure
- Public Economics: Taxation
- Public Choice
- Fiscal Federalism

Industrial Organization
- Firms and Markets
- Competition Policy
- Regulation and Public Enterprise
- Economics of Natural Resources

Monetary Economics
- Microeconomic Aspects of Monetary Theory
- Macroeconomic Aspects of Monetary Theory
- Aspects of Financial Intermediation
- Explorations in Monetary Economics

International Economics
- International Trade: Theory and Policy
- International Monetary Theory and Policy
- Topics in International Economics
- Economic Development: International Aspects

Economic Development
- Theory of Economic Development
- Economic Development: Internal Aspects
- Economic Development: International Aspects
- Environmental Aspects of Economic Development

Comprehensive Examinations

Oral examinations are not compulsory but a candidate may be required by the examining committee to sit an oral examination.

• Theory

Each student will attend the Ph.D. Tutorial course, 43.690 (ECO7990), in preparation for the theory comprehensive examinations. There are two theory examinations, in micro- and macro-economics, to be written within twelve months of beginning full-time study.

• Fields

Students will be required to write comprehensive examinations in two fields.

Thesis and Workshop Requirements

Thesis

Doctoral students will write and defend a Ph.D. dissertation. In preparing the dissertation, the student is required to give two seminars in departmental workshops. In the first, a research proposal for the dissertation will be presented and evaluated by three faculty members of the relevant workshop. In the second, a substantial portion of the research for the dissertation will have been completed and will be presented and evaluated as above. The workshops are requirements for graduation, and students will receive two half-credits for them.

Workshops

Students are encouraged to attend and participate in the regular departmental workshops relevant to their fields of interest and research. Such workshops are conducted in five areas:

• Industrial Organization
• Public Economics
• International Economics
• Monetary Economics
• Economic Development

Further details about this Joint Ph.D. program may be obtained by writing to the Director of Doctoral Studies, Joint Doctoral Program in Economics, either at the Department of Economics, Carleton University, or at the Department of Economics/Département de Science Economique, University of Ottawa.

Academic Standing

Doctoral students must normally obtain a grade of B− or better in each course counted towards the degree.

Graduate Courses*

Enrolment in graduate courses requires the permission of the Department, through the supervisor of graduate studies.

• Economics 43.501F1
Microeconomic Theory I
An examination of the theories of the behaviour of individual economic agents: consumers and producers and their relation to the theories of price determination.

• Economics 43.502F1
Macroeconomic Theory I
Macroeconomic theory and its implications for economic policy are surveyed in this course, comparing alternative approaches for a variety of topics.

• Economics 43.503W1
Microeconomic Theory II
A continuation of Microeconomic Theory I.

• Economics 43.504W1
Macroeconomic Theory II
A continuation of Macroeconomic Theory I.

• Economics 43.505W1
Econometrics I
Estimation and testing of the general linear model, with emphasis on problems such as auto-correlation, heteroscedasticity, multicollinearity, and problems due to distributed lags and errors in variables. Introduction to simultaneous equations systems, identification, and estimation.

• Economics 43.507F1, W1, S1
Directed Readings
Prerequisite: Permission of the Department.

• Economics 43.508F1, W1, S1
Special Topics
Prerequisite: Permission of the Department.

• Economics 43.509F1, W1, S1
Directed Research
At least one paper will be required from a student enrolled in any one of these courses.
Prerequisite: Permission of the Department.

• Economics 43.511F1
Canadian Economy I
A detailed examination of aspects and problems of the Canadian economy. A variety of topics may be discussed, including the economic development of

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* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Canada, the structure of the current national and regional economies, industrial organization, factor market operation, income distribution, the role of international trade and capital flows, and the stability of the economy.

- Economics 43.512W1
Canadian Economy II
Economic theory applied to the workings of the Canadian economy. Empirical estimation of various aspects of factor market operation, production, distribution, and aggregate economy. Participants are expected to prepare and present papers for discussion.

- Economics 43.521F1
History of Economic Thought I
The crucial achievements in economic theory and doctrine in the nineteenth and twentieth centuries are studied. Special emphasis is given to the interrelationship between the social environment and economic thought — especially to the role of economics in the development of the national state and international institutions.
Also offered at the undergraduate level, with different requirements, as 43.415, for which additional credit is precluded.

- Economics 43.522W1
History of Economic Thought II
A continuation of 43.521.
Also offered at the undergraduate level, with different requirements, as 43.415, for which additional credit is precluded.
Prerequisite: Economics 43.521 or permission of the Department.

- Economics 43.525F1 (ECO7125; 7525)
Mathematical Economics
General equilibrium; dynamic optimization; game-theory.

- Economics 43.531F1 (ECO6140; 6540)
Firms and Markets
An examination of theories pertaining to industrial organization, and their application to particular industries in Canada and elsewhere by way of empirical studies.

- Economics 43.532W1 (ECO6141; 6541)
Competition Policy
An examination of the rationale and application of competition policy with particular attention to the Canadian economy.

- Economics 43.533S1 (ECO6142; 6542)
Regulation and Public Enterprise
An examination of regulation and public enterprise as alternative approaches for influencing industry conduct and performance.

- Economics 43.535F1 (ECO6143; 6543)
Economics of Natural Resources
Elements of dynamic optimization. Microeconomic theory of exhaustible natural resources, both renewable and non-renewable: exploration, development and production. Uncertainty: sources, types, the value of information, informational externalities, search. Optimal jurisdiction over regulation and taxation of natural resources. Canadian case studies. Macroeconomic theory: intergenerational equity; technological substitution and impact upon growth.

- Economics 43.538W1
Law and Economics
This is a course in the interrelationship of law and economics, emphasizing the concepts of transaction costs and property rights. Economic theory will be used to analyze a variety of topics, ranging from the allocative effects of alternative property rights structures to contract, tort, and nuisance law. Special attention will be given to applied problems, such as the economics of crime, pollution, pay television, and eminent domain.

- Economics 43.539W1
Applied Industrial Economics
This course examines the application of industrial economics, with special emphasis to the Canadian and North American economies. Topics include the structure of consumer demand, firm production and investment, industrial structure and international trade. The structure of production and investment of particular industries will be analyzed and the effect of government policies (such as tax and tariff) on industrial development will be examined.
Also offered at the undergraduate level, with different requirements, as 43.439, for which additional credit is precluded.

- Economics 43.541F1 (ECO6130; 6530)
Public Economics: Expenditure
A discussion of the role of government expenditure, both in theory and with reference to the Canadian economy.

- Economics 43.542W1 (ECO6131; 6531)
Public Economics: Taxation
An analysis of the effects of various forms of taxation on economic performance.

- Economics 43.543W1 (ECO6133; 6533)
Public Choice
Democracy, bureaucracy, and economic policy. The public choice of fiscal constitutions, tax shares, and equity rules, voting coalitions and income distribution; the public provision of private goods; public sector size, fiscal illusion, and taxpayer revolts.

• Economics 43.544W1 (ECO6132; 6532)
Fiscal Federalism
This course examines the economic aspects of federalism, including efficiency, redistribution, consideration of a federal system of government, intergovernmental grants, and problems of stabilization policy in a federal context.

• Economics 43.545W1
Theoretical Welfare Economics
A rigorous treatment of the theoretical foundations of welfare economics.

• Economics 43.547W1
Project Evaluation
An analytical treatment of the principles of project evaluation and their applications.
Prerequisite: Economics 43.501 or permission of the Department.

• Economics 43.550F1 (ECO6170; 6570)
Theory of Economic Development
This course will deal with theoretical approaches in the economic development literature in relation to the historical, economic, environmental, social and political dimensions of the development process.

• Economics 43.551F1
Economic Dynamics: Cycles
An analysis of the nature and causes of fluctuations in income, prices, and employment. Shortrun dynamic models arising from multiplier-accelerator and other economic processes will be examined. Cycle simulation, forecasting, stability conditions, anti-cyclical policy, and the problems of maximizing growth without cycles will be discussed.
Also offered at the undergraduate level, with different requirements, as 43.451, for which additional credit is precluded.

• Economics 43.552W1
Economic Dynamics: Growth
An examination of modern theories of economic growth.
Also offered at the undergraduate level, with different requirements, as 43.446, for which additional credit is precluded.

• Economics 43.553W1
Stabilization Policy
An examination of policies aimed at achieving internal and external stability. The implications of economic growth for stabilization policies will be discussed.
Prerequisite: Economics 43.502.

• Economics 43.554W1 (ECO6171; 6571)
Economic Development: Internal Aspects
An analysis of major domestic problems of economic development. Topics may include employment,

income distribution, choice of technology, sectoral allocation of resources, human resource development, and domestic environmental issues.

• Economics 43.555F1 (ECO6172; 6572)
Economic Development: International Aspects
An analysis of key problems of international economic development such as trade in primary commodities and manufactures, financial flows and debt, the role of multinational corporations, the transfer of technology, and the international dimensions of environmental issues as they relate to the developing countries.

• Economics 43.557W1 (ECO6173; 6573)
Environmental Aspects of Economic Development
Policy aspects of sustainable economic development and environmental quality in developing countries. Topics to include energy use, deforestation, drought and desertification, depletion of natural resources, debt, environment and poverty, sustainable industrial and agricultural development, conservation policies, pollution control and global environmental issues. The course could be offered in lecture or seminar format.

• Economics 43.561F1 (ECO6160; 6560)
International Trade: Theory and Policy
International trade theory and its implications for economic policy are examined, with emphasis on topics such as determinants of trade and specialization, gains from trade and commercial policy, international factor mobility, growth, and development.

• Economics 43.562W1 (ECO6161; 6561)
International Monetary Theory and Policy
International monetary theory and its implications for economic policy are examined, with emphasis on topics such as sources of equilibrium and disequilibrium in the balance of payments, balance-of-payments adjustment under fixed versus flexible exchange rates, international capital movements, and recent issues in the international monetary system.

• Economics 43.563W1 (ECO6162; 6562)
Topics in International Economics
An examination of key topics in international economics, including theoretical analysis, quantitative methods and policy formulation, implementation, and evaluation.
Prerequisite: Economics 43.561 or 43.562.

• Economics 43.566F1 (ECO6180; 6580)
Microeconomic Aspects of Monetary Theory
A course on the microeconomic foundations of monetary theory concerned with alternative theories for the existence of money and ranging in coverage from commodity monies to private monies with banking systems to costless fiat money systems.

The focus of the course will be on how money integrates with the theory of value and the different theoretical ways in which this integration has been modelled.

● Economics 43.567W1 (ECO6181; 6581)
Macroeconomic Aspects of Monetary Theory
A course in monetary theory that deals with the macroeconomic interactions of money. Issues will include such topics as: inflation, money and wealth; the optimum quantity of money; the welfare aspects of monetary economies; the supply of money and its composition; stabilization policy; money, capital and growth.

● Economics 43.568F1 (ECO6182; 6582)
Aspects of Financial Intermediation
The evolution of the financial system with special emphasis on the theory of financial institutions and its interrelationship with the money supply process and the central bank. The course is designed to use contemporary monetary and finance theory to analyze institutional problems in both their historical and contemporary settings.

● Economics 43.569W1 (ECO6183; 6583)
Explorations in Monetary Economics
A course in which explorations in theory, policy recommendations and empirical study are undertaken. The material challenges traditional approaches by examining such topics as the endogeneity of money, the role of credit, the finance motive, the circuit approach, flow of funds analysis and austerity policies.

● Economics 43.571F1 (ECO7126; 7526)
Econometrics II
Selected topics from estimating and testing the regression and simultaneous equation models are analyzed. The main topics include maximum likelihood estimation, statistical analysis of residuals, autoregressive and other time-series models, multivariate regression model, and elements of asymptotic statistical theory within the context of the simultaneous equation model.
Prerequisite: Economics 43.505 or equivalent.

● Economics 43.572W1
Applied Econometrics
A discussion of the major problems encountered in applying the tools and techniques of econometric methods to statistical data for economic analysis and forecasting. Some selected topics and papers from the applied econometric literature are critically analyzed and appraised.
Prerequisite: Economics 43.505 or equivalent.

● Economics 43.573W1
Applied Time Series Analysis
Introduces the basic concepts of time series analysis with emphasis on models used in economics. Topics include stationary and nonstationary time series, model identification and estimation, transfer functions, and forecast computation.

● Economics 43.581F1
Regional Economics
Regional economic disparities in Canada, theories and public policy relating thereto. Consideration will be given to the concept of regions, location of industry and industrial structure and to growth determinants.

● Economics 43.582W1
Urban Economics
An examination of the economic properties of urban areas. Attention will be focused on the macrodynamics of urban development, together with the microstatics of the equilibrium properties of the urban land market.

● Economics 43.586F1
Comparative Economic Systems I
This course builds a framework for the study and comparison of economic systems. Using basic economic tools, it discusses the properties and comparative advantages of different contemporary economies, as well as the forces that cause or prevent change. Some Marxian theory will be included, along with analyses of the role of property rights, of incentives and motivation, and of the interaction between economic and political systems.
Also offered at the undergraduate level, with different requirements, as 43.486, for which additional credit is precluded.

● Economics 43.587W1
Comparative Economic Systems II
A comparison of contemporary economic systems. Such diverse economies as Japan, West Germany, Sweden, the USSR, China, Cuba, Yugoslavia, and Hungary may be explored.
Also offered at the undergraduate level, with different requirements, as 43.487, for which additional credit is precluded.

● Economics 43.593F1
Mathematical Methods for Economists
This course provides a rigorous review of mathematical techniques in economics, such as: matrix algebra, static optimization, nonlinear programing, and difference and differential equations. It then introduces the theory of optimal control, dynamic programing, and real analysis. Applications of these tools to various parts of economic theory are presented.

• Economics 43.599F3, W3, S3
M.A. Thesis

• Economics 43.600W1 (ECO7922)
Economic Theory: Microeconomics
An examination of critical aspects of microeconomic theory drawn from recent analysis of consumer behaviour, costs and production, transaction costs, uncertainty, and the organization of economic activity.
Prerequisite: Economics 43.501 or equivalent.

• Economics 43.601W1 (ECO7923)
Economic Theory: Macroeconomics
An examination of critical aspects of macroeconomic theory drawn from recent analysis of the microeconomic foundations of macroeconomics, concepts of macroeconomic equilibrium and the impact of monetary and fiscal disturbances. Attention is also directed to a variety of topics related to the conduct of macroeconomic policy.
Prerequisite: Economics 43.502 or equivalent.

• Economics 43.604W1 (ECO7127; 7527)
Theory of Choice
The concept of choice in economics. Opportunity for choice. Criteria of choice. Individual choice. Collective and social choice. Methods of choice. Applications.

• Economics 43.606F1 (ECO7930)
Economic Models and Policy Applications
Selected topics in the literature of econometric model building and consideration of their relevance to the design of economic policy. Included is a survey and comparative analysis of existing Canadian and American macroeconometric models. A detailed examination of one Canadian model will be made, and students will have the opportunity to conduct policy simulations with it or another econometric model.
Prerequisite: Economics 43.505 or equivalent.

• Economics 43.607W1 (ECO7900)
Research Methods in Economics
Philosophy of science and scientific methods. A critique and an appraisal of the basic postulates of the classical, neo-classical, Marxian, Keynesian and post-Keynesian modes of theorizing in relation to the following three principles of scientific inquiry: rigour, realism and relevance. The concepts of structure, function, structural change and evolution. Structural stability and the theory of catastrophies in economics.
Prerequisite: Economics 43.505 or equivalent.

• Economics 43.611F1, W1, S1 (ECO7010; 7011; 7012; 7013; 7014)
Workshop in Economic Policy

See requirements under *Thesis and Workshop Requirements.*

• Economics 43.670F1, W1, S1 (ECO7980)
Reading Course in Canadian Economic Policy and Economic Development

• Economics 43.690W1, S1 (ECO7990)
Ph.D. Tutorial
Students must register in the microeconomics and macroeconomics tutorials in either the winter or spring term.

• Economics 43.699F10, W10, S10 (ECO9999)
Ph.D. Thesis

Department of Geography

Loeb Building B349
Telephone: 788-2561
Fax: 788-4301

The Department

Chair of the Department:
M.W. Smith
Departmental Supervisor of Graduate Studies:
A.F.D. Mackenzie
The Department of Geography offers programs of
study and research in human and physical
geography leading to the degree of Master of Arts.
Master of Science and doctoral studies in physical
geography can be undertaken in cooperation with
the Ottawa-Carleton Geoscience Centre. Doctoral
studies in other fields of geography may, in special
cases, be undertaken in cooperation with other de-
partments.

Students are accepted into the graduate program
based on the standard of previous academic work,
research interests, letters of reference, and the avail-
ability of faculty to act as supervisors. Each student's
program of study, as far as possible, is based on the
interests of the individuals, although certain courses
may be required. An advisory committee, consisting
of the student's research supervisor and at least one
other member of the faculty, is established to moni-
tor progress and provide thesis research guidance.

Excellent research laboratory facilities exist for
the geotechnical study of near surface processes,
and the physics, chemistry and thermodynamics of
earth materials, as well as for computer cartography
and for remote sensing. These facilities are supported
by a highly qualified full-time staff in laboratory
instrumentation, cartography, and computing. There
is a specialized Map Library in the geography build-
ing. The university's location in Canada's capital
city offers students access to important federal
resources, such as the National Library, the Public
Archives of Canada, the Canada Centre for Remote
Sensing, Statistics Canada, and the specialist librar-
ies of many government departments.

Systematic interests of departmental members are
applied to a variety of world regions, although stress
is given to Canada (including northern studies) and
the Third World (especially Africa). The main clus-
ters of specialization within the department are the
following:

Physical Geography and Geotechnical Science
Studies of natural processes close to the earth's
surface and their geotechnical significance; climate-
ground interaction; geocryology; chemical, physical
and thermodynamic characteristics of soils and sedi-
ments; hydrology.
(C.R. Burn, Joyce Lundberg, M.W. Smith, J.K.
Torrance, T.P. Wilkinson, P.J. Williams)

Resource Development
Identification and analysis of development processes;
the interplay of environmental, demographic, social,
gender, political, and economic variables in the
spatial development of land resources, settlement
systems, outdoor recreation, tourism, and natural
resource-based industries; environmental impact
assessment and environmental management;
Canadian and Third World development is stressed.
(M.J. Brklacich, John Clarke, M.F. Fox, A.F.D.
Mackenzie, E.W. Manning, G.I. Ozornoy, M.H.
Sadar, M.W. Smith, D.R.F.Taylor, J.K.Torrance,
A.I. Wallace, T.P. Wilkinson)

Cultural, Historical, and Political Geography
Rural and urban settlement history; ethnicity; terri-
torial organization and the concepts of state, group
politico-territorial identities, territoriality, and self-
determination; role of territory in conflict situations;
perceptions of environment and geographies of the
mind; gender as a cultural variable; urban heritage
conservation.
(John Clarke, Simon Dalby, V.A. Konrad, Suzanne
Mackenzie, I.C. Taylor, John Tunbridge)

Social and Economic Geography
Geographical analyses of the social and economic
organization of societies; area variations in social
well-being; medical geography; provision of public
and informal services in changing local and regional
environments; implications of gender roles for envi-
ronmental restructuring; industrial systems; philoso-
phy of science and of geography.
(David Bennett, Simon Dalby, A.F.D. Mackenzie,
Suzanne Mackenzie, G.I. Ozornoy, D.M. Ray, A.I.
Wallace)

Computer Cartography and Remote Sensing
Development of applications in computer cartogra-
phy and the use of remote sensing in geographical
research.
(M.F. Fox, D.J. King, D.R.F. Taylor, T.P. Wilkinson).

The opportunity for wider experience in cartography may be obtained through arrangements by which a student may take for credit at Carleton University one or more courses in cartography offered by the Department of Geography, Queen's University. The principal areas of focus are map design and history of cartography at Queen's, and applied aspects of computer-assisted cartography at Carleton. Students following the cooperative cartography program may register in either department, and will follow the normal regulations and requirements for their university of registration. When appropriate for students in the cooperative program, representatives from both universities may be members of a student's thesis examining board. Financial aid for transport between cities will be provided by the home department.

Qualifying-Year Program

Applicants with exceptional promise who have a general (pass) bachelor's degree, or who have substantially less than the honours B.A. in Geography may be admitted to a qualifying-year program. To be considered for admission into the master's program, qualifying-year students must attain at least an overall high honours standing in their qualifying-year geography courses. The general section of this calendar provides details about the regulations governing the qualifying year.

Master of Arts

Admission Requirements

The normal requirement for admission into the master's program is an honours B.A. or B.Sc. in Geography with at least high honours standing. In exceptional cases, pertinent work experience may be considered in support of an application to the Department. Applicants who have taken their undergraduate degree in the physical or natural sciences or engineering, as well as in physical geography, will be considered if their research interest coincides with those of the Department. Applicants in human geography may be accepted from related fields if their proposed research is closely related to faculty research experience. Students with academic deficiencies may be required to take additional courses.

Program Requirements

The M.A. in Geography normally takes from twelve to eighteen months, but field work may necessitate some extension. All master's students in geography are required to complete a minimum of five full courses or the equivalent, including an M.A. thesis (equivalent to two full courses) which must be

successfully defended at an oral examination. All students are required to have a reading knowledge of the language considered essential to their research.

In addition to the formal requirements it is required that M.A. students will normally attend a Graduate Field Camp and the Departmental Seminar series.

Graduate Courses*

In addition to the selection of courses offered by the department, graduate students in geography are encouraged to consider, in partial fulfilment of their degree requirements, appropriate courses offered in such disciplines as biology, chemistry, economics, engineering, geology, history, international affairs, physics, political science, and sociology.

Courses at the University of Ottawa may also be taken for credit in a Carleton M.A. program; permission of the departments in both universities is required.

The following courses, normally offered annually, are tentatively scheduled for 1994-95:

- Geography 45.500F1
Approaches to Geographical Enquiry
A review of the major philosophical perspectives shaping research and explanation by geographers. Particular attention is paid to interpretations of social structure and human action, the nature of the biophysical universe, and the interaction between human beings and their environments.
David Bennett.

- Geography 45.505W1
Global Environmental Change: Human Implications
The nature of contemporary changes in global environmental systems and their significance for society, the economy and international relations. Phenomena such as climatic warming, deforestation, and the environmental pressures of urbanization and intensive agriculture are analyzed in terms of their regionally differentiated impacts and challenges for societal adaptation.
(Also offered as International Affairs 46.571)
A.I. Wallace.

- Geography 45.517F1, W1, S1
Field Study and Methodological Research
Field acquisition and analysis of geographic material; supervised field observations and methodology. (Individual or group basis, by special arrangement.)
Coordinator: Supervisor of graduate studies.

- Geography 45.520W1
Issues in Development in Africa
Analysis of structures and processes of political, social and economic change in intertropical Africa at scales ranging from the intrahousehold and local community to the state and international system. An objective is to integrate gender and the environment into analyses which draw on theories of political economy.
(Also offered as International Affairs 46.563)
A.F.D. Mackenzie

- Geography 45.532F1
Soil Thermal and Hydrologic Properties
Instrumental techniques for investigation of hydrological and thermal processes near the earth's surface, laboratory instrumentation, and analysis of laboratory and field procedures in geotechnical science.
(Alternates with Geography 45.530)

- Geography 45.533W1
Periglacial Geomorphology
Permafrost, its distribution and significance, seasonal ground freezing, ground thermal regime, physical, thermodynamic, and geotechnical properties of freezing and thawing soils, terrain features ascribable to frost action, and solifluction and patterned ground.
P.J. Williams.

- Geography 45.534F1
Aspects of Clay Mineralogy and Soil Chemistry
The role of clay minerals in soils will be considered from a geotechnical and/or biological perspective.
J.K. Torrance.

- Geography 45.537W1
Soil Resources
The properties of soils, development, classification, productive potential, and management problems of the world's soils. Primary emphasis will be agricultural, but environmental and geotechnical aspects will be considered.
J.K. Torrance.

- Geography 45.540F1
Territory and Territoriality
Evolution of the Western meaning of territory is examined against contrasting contemporary concepts in the Third World, especially Africa. Significance of territory and territoriality: their impact on restructuring of political space, territorial claims, self-determination, conflict, and processes of development.
(Also offered as International Affairs 46.542)
Simon Dalby.

- Geography 45.541F1
Society and Space
Analysis of geographer's contributions to contemporary social theory and of the geographical significance of theoretical debates in related fields.
Fran Klodawsky.

- Geography 45.542F1, W1
Selected Concepts in Social Geography
Theme to be announced.

- Geography 45.543F1
Selected Concepts in Cultural Geography
Investigation of a substantive theme in cultural geography.
Theme to be announced.

- Geography 45.544F1
Gender and Environments
This course examines the relation between gender role change and the creation and use of environments. Changes in people's activities, in the first and third worlds, are assessed in the context of feminist analyses. Conceptual and methodological skills for gender-sensitive research are developed. Subsequent directed field experience may be achieved by taking 45.517.
A.F.D. Mackenzie.

- Geography 45.545W1
Problems in Historical Geography
Philosophical and methodological approaches in geography, history, and historical geography, emphasizing the use of primary documents, model building and statistical methods as they relate to the historical geography of Canada.
John Clarke.

- Geography 45.550F1
Spatial Dynamics of Urban and Regional Change
A review of recent theoretical and methodological debate in this field and analysis of the changing geography of production, employment and social consumption in advanced economies. Policy issues will be considered.

- Geography 45.555W1
Tourism and International Development
The nature and effect of tourist development in various parts of the world, and the role of tourism in developed and developing countries.

- Geography 45.558W1
Agribusiness North and South
Analysis of the transformation of agriculture into an integrated multi-sectoral food production system and of its theoretical implications. Focus on the growth and strategies of agribusiness institutions in

advanced industrial societies and of their penetration into, and impact upon, Third World economies. (Also offered as International Affairs 46.534) A.I. Wallace.

• Geography 45.570W1
Problems of Development in Arctic and Subarctic Environments
Research seminar on specific problems in Canada's northland. Experience from other parts of the world will be incorporated when appropriate.

• Geography 45.572W1
Issues in Canadian Resource Development
The economic, environmental and social challenges facing Canadian resource-based industries and the communities they support. Focus on the agricultural, energy, forest and mineral sectors. The global and national contexts of the political economy of production, marketing and resource management are reviewed.

• Geography 45.579F1
Research and Development in Outdoor Recreational Geography
Developments and research in Canadian recreational land use; leisure time trends and recreational land use patterns, supply and user preferences, impacts and conflicts, wilderness recreation, landscape classification, and park system planning and management.

• Geography 45.580W1
Spatial Information Systems and Computer Cartography
The concepts and problems involved with spatial information systems, especially those with a mapping component.

• Geography 45.583W1
Remote Sensing and Image Analysis
Radiometric, geometric and resolution characteristics of remotely sensed data, image processing algorithms, analysis of spectral, textural, and contextual image information, applications to vegetation mapping and environmental analysis.

• Geography 45.584F1
Introduction to Geographic Information Systems
Introduction to geographical application of GIS for students with no previous experience. Includes benefits and limitations of GIS, data formats and structures, input/output capabilities, analysis functions, and applications.

• Geography 45.590F1, W1, S1
Graduate Tutorial
Tutorial, directed reading or research, offered on an individual basis, to meet specific program needs;

may be taken in one of the areas of specialization of the department.
Coordinator: Supervisor of graduate studies.

• Geography 45.599F4, W4, S4
M.A. Thesis
Thesis supervision will be given in all areas of specialization of the department, as listed in the calendar section identifying departmental specialization.
Coordinator: Supervisor of graduate studies.

Courses Not Offered in 1994-95

45.530   Soil Thermal and Hydrologic Regimes
45.555   Tourism and International Development
45.579   Research and Development in Outdoor Recreational Geography
45.581   Seminar in Map Design
45.582   Seminar in Historical Cartography

The Norman Paterson School of International Affairs

Paterson Hall, Level 2A
Telephone: 788-6655
Fax: 788-2889

The School

Director of the School:
M.A. Molot
Associate Director:
Martin Rudner

The Norman Paterson School of International Affairs, established in 1965 with the generous support of the late Senator Norman M. Paterson, offers a program of studies leading to the M.A. degree.

The program focuses on three themes:
- Conflict Analysis
- Development Studies
- Political Economy

The program affords students the opportunity to focus on Canada in international affairs through specialized courses related to each of these themes. The program also allows students to focus on international management issues relevant to governmental and non-governmental organizations and international enterprise. Attention is also paid to the role of international institutions, the foreign policies of other countries, and to selected regional studies. The School maintains close cooperation with the Institute of Central/East European and Russian-Area Studies, and with committees designed to encourage and coordinate faculty and student interests in Africa, Asia and Latin America.

A specialized resource centre is located in the School and is staffed by a full-time information specialist. Students and faculty have access to a broad range of current bibliographic materials, using the resources of the national capital area as well as on-line computerized bibliographic services in foreign policy and international affairs. The School also participates in the Social Science Data Archives at Carleton, and students have access to a full range of data sets available from the Inter-University Consortium for Political Research, as well as the Canadian Institute of Public Opinion poll data and the Human Relations Area Files.

Qualifying-Year Program

Admission Requirements
The qualifying-year program is designed to enable students with at least high honours standing, but with an inadequate background in the disciplines relevant to the M.A. program, to make up deficiencies. Candidates with a high standing in a general (pass) bachelor's degree, in a discipline closely related to international affairs, will be required to take five qualifying-year courses before being eligible to enter the master's program. Those with an honours bachelor's degree in an unrelated discipline may be required to take at least three qualifying-year courses before being eligible to enter the master's program.

Students in the qualifying year are encouraged to select a core theme. They may also wish to select an area emphasis and to take courses that will enable them, in the M.A. year, to engage in specialized study in the problems of a region having particular relevance to the core theme they have elected. Students should also take appropriate courses in order to prepare them to fulfil the language requirements of the M.A. program.

Admission to the qualifying year does not guarantee admission to the M.A. program. To be considered for admission to the M.A. program, students in the qualifying year are expected to achieve the equivalent of high honours standing. Students in the qualifying year are considered for admission to the M.A. program at the same time as other applicants; if qualifying-year students are not admitted to the M.A. program in the first round of admissions, subsequent decisions on their admission will depend on performance and the availability of space in the M.A. program.

Program Requirements
Conflict Analysis
Students will normally enroll in Political Science 47.361 and 47.365, or 47.460. Students who have not already taken an introductory course in international politics should enroll in Political Science 47.260. Courses in anthropology, economics, geography, history, law and sociology, among other disciplines are recommended as well as courses concerned with alternative approaches to conflict and conflict resolution, and area studies.

Development Studies
Students will normally enroll in Economics 43.363. Students who have not already taken an introductory economics course should enroll in Economics 43.100. Courses related to development studies in anthropology,

geography, history, law, political science, and sociology, among other disciplines are recommended as well as courses concerned with international economics and politics, and comparative and area studies.

International Political Economy

Students will normally enroll in Political Science 47.361 and 47.365, or 47.460, and Economics 43.360, or 43.361 and 43.362. Students who have not already taken an introductory economics course should enroll in Economics 43.100. Courses in anthropology, geography, history, law, and sociology, among other disciplines, are recommended as well as courses concerned with political economy, the state, economic history, and comparative and area studies.

Master of Arts

Admission Requirements

The minimum requirement for admission into the master's program is an honours bachelor's degree in a discipline related to international affairs. Under current practice, at least a high honours standing is normally required for consideration for admission to the program.

Students may wish to provide scores on the Graduate Record Examination aptitude test in order to assist the admissions committee.

The Faculty of Graduate Studies and Research requires applicants whose native tongue is not English to be tested for proficiency in English, as described in the application for admission section, page 17 of the general regulations of this calendar.

Candidates who lack the required background in international affairs will be expected to complete a maximum of two additional courses. Core seminar requirements are listed under program requirements for qualifying year.

In order to be considered for financial assistance, applications for admission to the School of International Affairs must be postmarked by January 15. Deadline for receipt of supporting documentation, i.e. letters of reference and transcripts, is February 15. Applications will be accepted after the January 15 deadline; however, such applications will not meet the financial aid deadline.

Students admitted to the *Conflict Analysis* core are strongly encouraged to complete a senior undergraduate course in conflict theory as well as courses in the social sciences, history, and law before beginning their programs. Students who have not completed a senior undergraduate half-course in conflict theory will be required to take such a course as part of their program requirements.

Students admitted to the *Development Studies* core must have completed an introductory economics course

prior to entry into the M.A. program. Students are also strongly encouraged to complete an undergraduate half course in development economics before beginning the M.A. program. Otherwise, this requirement (additional to the M.A.) will have to be taken simultaneously with the M.A. program, and may result in some delay in its completion.

Students admitted to the *International Political Economy* core must complete an introductory economics course prior to entry in the M.A. program. Students are also strongly encouraged to complete undergraduate courses in political economy, international economics, and international politics, as well as courses in geography, history, law and sociology before beginning their programs. Students who have not completed a course in international economics will be required to take International Affairs 46.538 as part of their program requirements.

Program Requirements

The normal program requirements for M.A. students in international affairs are:

- One interdisciplinary core seminar or equivalent selected from the following:

International Affairs
46.500   Theories and Approaches to International
            Political Economy
46.504   Development Studies
46.515   Conflict Analysis

- Two other approved courses (or the equivalent) in international affairs or related disciplines, if a student elects to write a thesis
- Three other approved courses (or the equivalent) in international affairs or related disciplines, if a student elects to write a research essay
- A thesis (valued at two credits) or a research essay (valued at one credit) involving original research on an approved subject in the field of international affairs
- Full-time students are expected to submit a thesis/research essay proposal by the end of January following their first term of study in the program; part-time students are expected to submit a thesis/research proposal after completion of half of their course requirements
- An ability to read a second major international language, or a language appropriate to a student's major research interest
- An oral comprehensive examination on the thesis or research essay in their general field of study to determine the candidate's ability to relate various disciplines to the study of international affairs
- English-speaking Canadian students are expected to develop a proficiency in French

CONCENTRATIONS

Students in all three core seminars may, if they wish, choose to focus their studies on one of four concentrations as part of their overall program. The concentrations, designed to permit some specialization within the context of the M.A. degree, will be structured around particular sets of courses selected in consultation with a faculty adviser.

Canadian Concentration

This concentration focuses on Canadian policies and activities in international affairs. It will be of interest to students wishing to focus their studies on the formulation and implementation of Canadian foreign policy in the areas of international security, trade and investment, or development assistance. The concentration will include:
- one of the three interdisciplinary core seminars
- one of International Affairs 46.511, 46.512, 46.513
- a thesis or a research essay on a Canadian theme

International Management Concentration

Students may elect to include international management as part of their program in the School. This concentration will emphasize aspects of the international environment in which managers in the public and private sectors make decisions. It will be of particular interest to students who wish to pursue careers in international government and non-governmental organizations, international banking and multinational enterprises. The concentration will be designed in consultation with a faculty coordinator and will include:
- one of the three interdisciplinary core seminars
- International Affairs 46.544
- courses from among those offered by the School of International Affairs, and by the Schools of Business and Public Administration
- a thesis or a research essay on an international management theme

Students who have not completed a course in international economics will be required to take International Affairs 46.538 as part of their program requirements.

Environment Concentration

This concentration focuses on international aspects of the natural environment, including the relationship of the environment to development, environmental concerns of higher-income countries and global or planetary issues. The concentration will include:
- one of the three interdisciplinary core seminars
- one of International Affairs 46.570 or 46.571
- a thesis or research essay on an environmental theme

Trade Policy Concentration

This concentration emphasizes the formulation, administration and consequences of trade and trade-related policies. It will be of interest to those who wish to pursue careers in the trade policy area. The concentration will include:
- one of the three interdisciplinary core seminars
- International Affairs 46.540
- a thesis or research essay on a trade policy theme

Students will require International Affairs 46.538 or equivalent as a prerequisite for 46.540.

Academic Standing

A grade of B– or better must be obtained in each course credited towards the master's degree. The School does not permit exceptions to this rule.

Career Planning

Students interested in continuing to doctoral programs should plan their programs to include courses in their discipline, if other than international affairs, which may be deemed necessary for their admission to doctoral programs. Interdisciplinary doctoral programs in international affairs are given in a number of institutions and the faculty can provide guidance in planning for these programs.

Recent experiences of students show that a strong background in research methods and economics enhances job placement, and students may wish to take this into account in planning their course program.

School faculty can provide advice on careers in government, international governmental and non-governmental organizations, and in the private sector.

Master of Arts/Bachelor of Laws

The Norman Paterson School of International Affairs and the Common Law Section of the Faculty of Law at the University of Ottawa offer a joint Master of Arts in International Affairs and Bachelor of Laws degree (M.A./LL.B.).

Admission Requirements

A student must make separate applications to the School of International Affairs at Carleton University and to the Faculty of Law at the University of Ottawa and be accepted by both institutions in accordance with the normal admission requirements of each program. Interest in pursuing the joint program must be specified in each application and a joint committee will make a decision on admission to the joint program.

Program Requirements

A student will complete both the M.A. and the LL.B. programs over a four-year period. Students will be expected to fulfil the normal requirements of both the M.A. and LL.B. programs. In addition, students

in the joint program will be required to complete courses in international law to be specified by the Faculty of Law. The normal sequence of courses for the two degrees is as follows:

First Year
- Normal LL.B. first year.

Second Year
- Normal M.A. first year (required course work to include a half-credit course in international law, plus commencement of M.A. research essay/thesis)

Third Year
- Normal LL.B. second year, including one half-credit course from the School of International Affairs for which credit will be given in the LL.B. program,** and continuation of M.A. research essay/thesis

Fourth Year
- Normal LL.B. third year, including one half-credit course from the School of International Affairs for which credit will be given in the LL.B. program,** and conclusion and defence of M.A. research essay/thesis

**These two half courses in the School of International Affairs taken as credit toward the LL.B. will be additional to those required for the M.A. degree.

Graduate Courses*

Part-time students are permitted to enrol in a maximum of two half courses per term.

Core Seminars

- International Affairs 46.500T2
Theories and Approaches to International Political Economy
A study of global political economy, with emphasis on historical development, regional integration, and contemporary institutional structures.
Prerequisite: M.A. standing in the Norman Paterson School of International Affairs or permission of the School.

- International Affairs 46.504T2
Theories and Issues in Development Studies
The course examines theories of development and the international dimensions of development. It covers economic, environmental, political, ethical and social approaches to development. The seminar will focus on policy areas such as growth, equity and poverty alleviation; human resource development; developing countries and aspects of development including

international trade, finance and technology; sustainability of development; human rights and gender; ideology and nationalism; the role of the state and institutional change; and rural and urban development.
Prerequisite: M.A. standing in the Norman Paterson School of International Affairs or permission of the School.

- International Affairs 46.515T2
Conflict Analysis
A seminar comparing conflict theory drawn from strategic studies, peace research, and the social sciences, with applications to East-West conflict, regional conflicts, arms races and arms control, crisis management, and terrorism.
Prerequisite: M.A. standing in the Norman Paterson School of International Affairs or permission of the School.

Canadian Concentration

- International Affairs 46.511W1
Canada in the International Political Economy
Analysis and evaluation of Canada's relationships and policies within the context of the international political economy.
Prerequisite: Enrolment in International Affairs 46.500 or permission of the School.

- International Affairs 46.512W1
Canada and International Development
Analysis and evaluation of Canada's policies and programs with respect to international development.
Prerequisite: Enrolment in International Affairs 46.504, or permission of the School.

- International Affairs 46.513W1
Canada and International Conflict
Analysis and evaluation of Canada with respect to international conflict and conflict resolution.
Prerequisite: Enrolment in International Affairs 46.515 or permission of the School.

Other Courses

- International Affairs 46.505F1 or W1
International Dimensions in Development Studies
Issues in development financing, international trade, industrialization and technology transfer, food and natural resources, and the role of international organizations.
Note: Not open to students enrolled in 46.504.

- International Affairs 46.506F1 or W1
Agriculture and Rural Development
A study of the agricultural sector, rural areas, and rural welfare in developing countries, including consideration of structural change in agriculture, agrarian reform, rural development strategies in various countries, and public policies affecting

* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

agriculture, activities ancillary to agriculture, rural industry, and public service.

• International Affairs 46.507F1 or W1
Theories of Development and Underdevelopment
A comparative analysis of approaches to the study of development processes and underdevelopment, including structural-functional, neo-classical, Marxist, and dependency theories.
Note: Not open to students enrolled in 46.504.

• International Affairs 46.508F1 or W1
Development Planning: Theory and Practice
Third World development plans and strategies and their impacts; techniques employed in development planning, including social cost-benefit analysis, budgeting, and problems in development administration.

• International Affairs 46.521F1 or W1
Theory and Practice of Arms Control
This course explores the theoretical and analytical underpinnings of modern arms control, including nuclear non-proliferation issues in the post Cold War era with special emphasis on the impact of political, economic, technological and social-psychological factors on international security. In addition to arms control, complementary means of strengthening regional and international security will be addressed including crisis prevention strategies, unilateral initiatives, third party guarantees and informal agreements. Contributions from peace research highlighting alternative paths to stable and durable security arrangements will also be examined.

• International Affairs 46.522F1 or W1
International Security After the Cold War
This course examines the evolving strategic and security environment in international relations after the Cold war, addressing both traditional and non-traditional concepts of national and international security. These include the role of nuclear weapons, nuclear non-proliferation, and bilateral, multilateral, and institutional responses to new challenges to national security such as drugs, terrorism, environmental degradation, refugees, ethnic conflict and threats to renewable and non-renewable resources. The course will use an interdisciplinary approach in addressing these problems.

• International Affairs 46.523F1 or W1
International Mediation and Conflict Resolution
This seminar explores various approaches to the management and resolution of international economic, political and security conflicts. These approaches may include arbitration, conciliation and mediation as well as less formal mechanisms for third party consultation and collaborative problem solving.

The course focuses on the theory and practice of international conflict resolution, using cases drawn from a variety of issues and settings.

• International Affairs 46.527F1 or W1
Conflict in the Middle East
A critical examination of competing interpretations of conflicts in the Middle East region, including approaches to conflict resolution.

• International Affairs 46.529F1 or W1
Conflict in Southern Africa
A critical examination of competing interpretations of conflict in southern Africa, including approaches to conflict resolution.

• International Affairs 46.530F1
Political Economy of Multinational Enterprises
This course is designed to give the student an appreciation of recent economic and political developments in the fields of international trade and investment as they relate to the operations of multinational enterprises. The course will develop concepts and analytical approaches and provide examples in order to examine the impact of multinational enterprises on international affairs.

• International Affairs 46.532F1 or W1
Science, Technology and International Affairs: The Advanced, Industrial Countries
This seminar analyzes the process of technological change since the industrial revolution and examines its consequences for development in the advanced industrial countries and for relations among these countries.

• International Affairs 46.533F1 or W1
Science, Technology and International Affairs: The Third World
This seminar focuses upon the problem of building indigenous technological capabilities in the Third World. It examines the role of MNCs in the transfer of technology, the generation of appropriate technologies locally and the role of the state in the formulation of technology policy for development. Technological cooperation among Third World countries may also be discussed.

• International Affairs 46.534F1 or W1
Agribusiness North and South
Analysis of the transformation of agriculture into an integrated multi-sectoral food production system and of its theoretical implications. Focus on the growth and strategies of agribusiness institutions in advanced industrial societies and their penetration into, and impact upon, Third World economies.
(Also offered as Geography 45.558)

• International Affairs 46.535F1 or W1
International Bargaining and Negotiation: Theory and Practice
An examination of bargaining and negotiation in international economic, political and security issue areas, emphasizing case studies as well as theoretical analysis.

• International Affairs 46.537W1
Macroeconomics in a Development Context
An examination of macroeconomic theory and policy in the context of the developing countries, with special emphasis upon theory and policy for open economies, structural adjustment to international disequilibration, exchange rate and balance of payments management, fiscal and financial policy.

• International Affairs 46.538F1
International Economics: Policy and Theory
An overview of international finance, trade, investment, and international aspects of economic development. Emphasis will be placed on policy analysis and the underlying institutional context.

• International Affairs 46.539W1
International Financial and Monetary Institutions and Policy
A selective, in-depth review of issues such as balance of payments, adjustment processes, and the role of international financial and monetary institutions.

• International Affairs 46.540F1 or W1
Trade Policy Analysis
This course analyzes various international trade and trade-related investment policies using an international political economy approach. The course emphasizes theoretical and empirical techniques together with case studies. Topics include the comparison of alternative policy instruments to achieve national objectives; tariffs and non-tariff barriers to trade such as subsidies, quotas and trade-related investment measures; preferential trading arrangements; trade in services and trade-related intellectual property matters; exchange rate management; strategic trade policy; other policies related to competitiveness; and the role of interest groups in shaping trade policies. *Prerequisites:* International Affairs 46.538 or equivalent, M.A. standing in the Norman Paterson School of International Affairs or permission of the School.

• International Affairs 46.541F1 or W1
The International Economics and Politics of Resources
An examination of resource-related issues in the international system, focusing on energy, non-fuel mineral and agricultural areas.

• International Affairs 46.542F1 or W1
Territory and Territoriality
Evolution of the Western meaning of territory is examined against contrasting contemporary concepts in the Third World, especially Africa. Significance of territory and territoriality: their impact on restructuring of political space, territorial claims, self-determination, conflict and processes of development. (Also offered as Geography 45.540)

• International Affairs 46.544F1 or W1
The Environment for International Management
Analysis of the international economic environment in which managers in the public and private sectors operate. The course examines the reasons for the growing interdependence of nations in terms of trade and investment, and the relationship of investment to trade in goods and services. Problems of management associated with this interdependence will be identified, together with an examination of the nature and effectiveness of emerging international rules and standards.

• International Affairs 46.545F1 or W1
International Organizations in International Affairs
A critical analysis of the roles played by the United Nations and other international organizations in the field of international conflict, development, and political economy.

• International Affairs 46.546F1 or W1
Policy Analysis and Evaluation
This seminar examines approaches to the development and implementation of the international public policies of a number of countries, including Canada, in a variety of issue areas. The seminar focuses on case studies of economic, political, and security policy, and includes a consideration of organizational and systemic constraints on policy making as well as various concepts and methods for the evaluation of policy.

• International Affairs 46.547F1 or W1
International Relations Theory
This course provides an overview of theories of international relations. Organized both historically and conceptually, the course will examine a variety of theoretical approaches to international relations, among them the realist, liberal, structural, neo-realist, and critical perspectives.

• International Affairs 46.549F1, W1, S1
Selected Topics in International Affairs

• International Affairs 46.555F1 or W1
International Law: Theory and Practice
This course is designed to give students an appreciation of various theoretical perspectives on international law, with a view to locating the role which

international law plays in the international system. Topics considered include the basis of international law, the creation and sources of international law, the utilization of international law in international dispute-resolution, and international law and world order transformation. Illustrative issues will vary according to the interests of students each year.

(Also offered as Law 51.563)

• International Affairs 46.557F1 or W1
International Economic Law: Regulation of Trade and Investment
A study of selected problems associated with the regulation of international economic activity. The seminars will focus on a discussion of relevant international institutions (GATT, UNCTAD, IMF, World Bank), an introduction to the legal aspects of integration (e.g. EEC, ASEAN), governmental regulation of trade and investment (e.g. FIRA), and the problems of extraterritoriality.
Prerequisite: Open only to graduate students in their master's year who have not previously studied international economic law.
(Also offered as Law 51.520)

• International Affairs 46.560F1 or W1
Human Resource Development
An analysis of theory and policy regarding some of the major areas of human development in the developing areas, including demography and population, education, public health, nutrition, women and development, social security, employment, and manpower planning.

• International Affairs 46.561F1 or W1
Historical Dimensions of Development and Underdevelopment
Comparative studies in the economic and social history of selected developed and developing countries. The aim is to identify conditions which have fostered or inhibited development in the past, and thereby to assess contemporary development strategies in the light of historical experience.

• International Affairs 46.562F1 or W1
The Institutional Framework for International Assistance
The course will examine the institutions involved in international assistance, their political dynamics, organizational structures, policy orientations, transfer mechanisms, and development impact. Particular attention will be paid to the evolution of international assistance strategies and programs, and to the implications for North-South and East-West relations.

• International Affairs 46.563F1 or W1
Issues in Development in Africa
Analysis of structures and processes of social, political, and economic change in intertropical Africa at scales ranging from the intrahousehold and local community to the state and international system. An objective will be to integrate gender and the environment into analyses which draw on theories of political economy.

(Also offered as Geography 45.520)

• International Affairs 46.564F1 or W1
Issues in Development in Latin America
An examination of Latin America's principal developmental trends, problems and policies, as they have evolved during the past three decades. Emphasis will be given to the design and implementation of alternative development strategies through the remainder of the century.

• International Affairs 46.565F1 or W1
The Ethical Dimension of International Affairs
This course critically examines the ethical dimensions of development, global conflict, and international political economy. Subject matter includes beliefs and values, rights and obligations, and individual and state morality.

• International Affairs 46.567F1 or W1
Issues in Development in Southeast Asia
A comparative analysis of political and economic development in selected Southeast Asian countries, with particular attention to Indonesia, Malaysia, and Thailand. Major issues to be studied include the process of political and social change, the emergence of contemporary economic systems, the evolution of development policies and planning and their impact on agriculture and rural development, education, industrialization and trade expansion.

• International Affairs 46.568F1 or W1
Indigenous Perspectives on Third World Development
This course examines some of the major perspectives and theories on Third World Development which have emerged from within the Third World. Included are authors representing structural, dependency and radical theories of development, as well as those who see development as psychological or spiritual liberation. Views of some of the leading political figures of the Third World are also considered.

• International Affairs 46.569F1 or W1
Social Cost-Benefit Analysis and Development Project Evaluation
An examination of social cost-benefit analysis and project evaluation in the context of the developing countries, emphasizing applied case studies as well as theoretical analysis.

• International Affairs 46.570F1 or W1
The Natural Ecosystem
An analysis of human involvement in the natural environment as an ecosystem in the development context. Material will discuss how the environment continues to be modified and the possible long term consequences in the light of rapid technological advances. Special attention will be given to individual development projects including their political and social setting.

• International Affairs 46.571F1 or W1
Global Environmental Change: Human Implications
The nature of contemporary changes in global environmental systems and their significance for society, the economy and international relations. Phenomena such as climatic warming, deforestation, and the environmental pressures of urbanization and intensive agriculture are analyzed in terms of their regionally differentiated impacts and challenges for societal adaptation.
(Also offered as Geography 45.505)

• International Affairs 46.580F1 or W1
Pacific Economic and Political Relationships
A course on the nature and prospects of the Pacific basin economy. The main topics will include a review of the record of outward-oriented development strategies of Japan, Korea, Taiwan, Hong Kong and ASEAN; the economics and politics of U.S.– Japan relations and the prospects of China's participation in Pacific trade and development. Canada's economic and political interests in Pacific cooperation will also be studied. Attention will be paid to the prospects for regional institutional arrangements as well as bilateral links.

• International Affairs 46.581F1 or W1
Regional Cooperation Among Developing Countries
A comparative study of selected regional cooperation or integration schemes, including some or all of the East African Community, the Economic Community of West African States, Central American Common Market, CARICOM, the Andean Group, and the Association of South-East Asian Nations.

• International Affairs 46.582F1 or W1
The Political Economy of East-West Relations
This course examines the issues that have arisen in the political economy of East-West relations with the end of the Cold War. After a brief review of earlier periods in East-West relations, the course will focus on various aspects of the reintegration of the East European and former Soviet economies into the world economy: the controversies surrounding Western assistance, the role of foreign direct investment, concepts and issues in international security, problems, and prospects for integration into a

greater European economic sphere, the relationships emerging in the Asia-Pacific region, the changing nature of international organizations and Canada's stake in the era in East-West relations.

• International Affairs 46.584F1 or W1
International Relations in Europe
This course examines international relations and organizations in Europe from theoretical and historical perspectives focusing on the economic, social, political, and security changes in Europe, east and west. Topics include conflict and cooperation in and between European security organizations, the origins and development of the European community and changes in Europe following the end of the Cold War.

• International Affairs 46.588F1 or W1
International Political Economy
A seminar on the changing international division of labour and its consequences for world politics. Topics include differing patterns of industrialization, colonial relations, the role of the state, and current issues in international political economy.
Prerequisite: Work at a senior undergraduate level is required in at least two of the following: international relations, development studies, international trade, or political economy (or permission of the School).
Note: Not open to students enrolled in 46.500.
(Also offered as Political Science 47.588)

• International Affairs 46.591F1, W1, S1
Tutorials in International Affairs
To be chosen in consultation with the director.

• International Affairs 46.595F1, W1, S1
Research Workshop
This seminar focuses on the special problems of research design in the interdisciplinary field of international affairs, with materials drawn from both the established literature and the practice of leading members of the School's faculty.

• International Affairs 46.598F2, W2, S2
Research Essay

• International Affairs 46.599F4, W4, S4
M.A. Thesis

Selection of Courses

In addition to the graduate courses offered in the school, qualified students may choose from among courses in international affairs offered by related departments, schools and institutes.

Department of Law

Loeb Building C473
Telephone: 788-3690
Fax: 788-4467

The Department

Chair of the Department:
T.B. Dawson
Supervisor of Graduate Studies:
J.B. Wright

The Department of Law offers a program of advanced study and research leading to a Master of Arts degree in Legal Studies. The program is open to full-time and part-time students.

The M.A. program provides an interdisciplinary, theoretical, and research-oriented approach to studying law as a social and political institution, with emphasis on the relationship between law and social transformation. The plan of studies includes a range of fields linked by a common theoretical and methodological concern with the way law shapes and is shaped by its social environment. The program is designed to develop the conceptual and analytical skills required for conducting independent research on law and society.

Within this context, students will focus on one or more of the following areas of specialization:
• legal theory and social theory
• law, crime and social order
• women, law and gender relations
• political economy of law
• international and comparative legal regimes
• social history of law

The location of the M.A. program in Legal Studies at Carleton provides students with a wealth of resources for research purposes. As well as the resources of the MacOdrum Library, students will have access to extensive Canadian and international research material through the Social Science Data Archives located at Carleton. The Library of the Supreme Court of Canada, the National Library, the National Archives, the Library of Parliament, Statistics Canada and the Centre for Justice Statistics are all located in Ottawa. Ottawa houses many federal government departments and agencies, and the national headquarters of non-governmental organizations such as the Elizabeth Fry Society, the John Howard Society, and the National Association of Women and Law. Many government departments and non-governmental organizations maintain specialized libraries, and offer access to documents and other research materials.

Qualifying -Year Program

Applicants with exceptional promise who have less than honours B.A. status may be admitted into a qualifying-year program designed to raise their standing to honours status. To be considered for admission into the master's program students must obtain at least a high honours average in their qualifying-year courses.

Master of Arts

Admission Requirements
The requirement for admission into the M.A. program in Legal Studies is an honours bachelor's degree or the equivalent, with at least high honours standing.

Applicants will be considered for admission on the basis of their academic background and standing. Where relevant, previous professional experience may be taken into account.

Applicants without a background in law may be required to complete one or more designated courses, including 51.397*, Legal Research Methods, from the Department's undergraduate program before taking courses towards the Master's degree.

Program Requirements
In consultation with the supervisor of graduate studies, each candidate is required to complete the following program of studies:
• three full courses or the equivalent (3.0 credits); and
• a thesis (2.0 credits) and an oral examination.

All students are required to take 51.500: Theories of Law and Social Transformation; and Law 51.501: Legal Method and Social Enquiry. These courses provide students with a common theoretical and interdisciplinary framework for the program. The methods course is designed to develop the link between the theoretical orientation and the important research component of the program. Rather than seeking to provide all possible research skills, the course focuses on the importance of methodological issues and choices in research design.

In addition, students are encouraged to take at least one half course (0.5 credits) in a related discipline, in consultation with the supervisor of graduate studies.

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* At the undergraduate level, denotes a half-credit course

All students must obtain satisfactory grades in their course work; make satisfactory progress in their research; maintain a close working relationship with their thesis supervisors; and attend seminars on current research and related topics. Each student will be required from time to time to present a seminar on his/her research.

Thesis Regulations

The thesis must represent the result of the candidate's independent research undertaken after being admitted into Graduate Studies at the Department of Law. Previous work of the candidate may be used only as introductory or background material for the thesis.

A student may carry on research work related to the thesis off-campus if the work is approved in advance and supervision arrangements have been made with the supervisor of graduate studies.

Graduate Courses*

Core Courses

The two compulsory courses are designed to give substance to the major objectives of the program. They provide the theoretical and interdisciplinary framework which will set the terms of discussion and debate for the program. The courses are designated as compulsory because it is anticipated that students will be drawn from both law and social science backgrounds and consequently there is a need to provide a central and shared basis for the whole program. The methods course is designed to develop the link between the theoretical orientation and the important research component of the program. Rather than seeking to provide all the research skills that students might require, the course focuses on the importance of methodological issues and choices in research design.

- Law 51.500F1, W1 or S1
Theories of Law and Social Transformation
This course examines three groups of theories (liberal jurisprudence, sociological theories of law and Marxist theories of law). They are explored from two main perspectives: the first focuses on the different ways in which law is conceived as an object of inquiry; the second, and more empirical, examines the different accounts of trajectories of legal development from the period of industrial capitalism to the present, with its paradoxical processes of expanded legalization and legal centralism and the contrasting

delegalization and legal pluralism. The limits and potential of law as an agency for realizing or inhibiting different types of social change provide a framework for this comparative analysis.

- Law 51.501F1,W1 or S1
Legal Method and Social Inquiry
This course introduces problems associated with the choice of research strategy and methods. Starting from problems in the philosophy of social science it explores the connection between strategies and methods. It explores contrasting methodologies in legal research, such as: the handling of historical sources; sources and handling of statistical data; participant observation studies. It evaluates the potential and limitations of alternative methodologies employed in understanding legal reasoning, legal discourses and legal practices. The course includes a series of seminars in which participants present outlines of their research projects, focusing upon the methodological issues and problems involved.

- Law 51.599F4, W4, S4
M.A. Thesis

Other Law Courses

The following is a complete list of all graduate courses in the Department of Law. Please note that not all courses are offered every year. Students should consult the University and departmental timetables for the scheduling of courses offered in 1994-95.

- Law 51.502F1,W1 or S1
Law and Gender Relations
This course examines diverse theoretical approaches informed by the significance of gender to the structure and operation of law and legal institutions in society. Concepts such as essentialism, difference, cultural determination, and the social construction of gender relations are examined in the context of contemporary feminist debates. The aims of the course include development of a detailed understanding of and facility with feminist analysis and methodology.

- Law 51.503F1,W1 or S1
Law, Economy and Society
This course addresses the relationship between law, economy and society. Competing theoretical accounts of the relationship between legal regulation and social and economic change are explored through selected historical and contemporary case studies.

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* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• Law 51.504F1,W1 or S1
Law, Crime and Social Order
This course examines the theoretical dimensions of
the relationship between law, state, crime and social
order. It explores the scope and limitations of the
criminal justice system as an agency of social control.
Attention is given to shifts in the forms of social
order and their relation to changes in criminal law
and sanctions.

• Law 51.505F1,W1 or S1
Law, State and Politics
This course explores the relationship between the
law, state and politics. Major theoretical explanations
of the relationship are examined. Attention is focused
on the role of rights, the rule of law, separation of
powers and judicial review. The course examines
alternative views of the interrelationship between
political and legal change and developments in the
contemporary state.

• Law 51.506F1,W1 or S1
Historical Perspectives on Law and Society
This course examines the historical relationship
between social forces, law and legal institutions. It
surveys issues concerning legal historical theory,
and the foundations of modern legal concepts and
institutions. In particular, the course focuses on two
discrete areas; the relationship between socio-economic
change and private and regulatory law, and the
changing conceptions of crime and the nature of the
state's responses through the uses of criminal law.

• Law 51.507F1,W1 or S1
Race, Ethnicity and the Law
This course examines the way in which race and
racism interact with gender and class in shaping the
legal system. It also explores the ways in which the
legal system institutionalizes racism and the potential
for using the legal system to combat racism. Selected
areas such as immigration law and native rights
may be used to illustrate the themes of the course.

• Law 51.510F1, W1 or S1
Advanced Problems in Legal Philosophy
Studies in legal theory and analyses of law advanced
by Hart, Dworkin and others, and legal concepts:
for example, principles, rights, duties, liability, etc.
Precise course content will vary from year to year
and will be announced at the beginning of the term.
Prerequisites: Either Law 51.315 or 51.311
(32.311) and 51.312(32.312) or permission of the
Department.
(Also offered as Philosophy 32.510)

• Law 51.520F1,W1 or S1
International Economic Law: Regulation of Trade
and Investment
A study of selected problems associated with the
regulation of international economic activity. The
seminar focuses on a discussion of relevant
international institutions (GATT, UNCTAD, IMF,
World Bank), and introduction to the legal aspects
of integration (e.g. EEC, ASEAN), governmental
regulation of trade and investment (e.g., FIRA), and
the problem of extraterritoriality. (Also offered as
International Affairs 46.557)

• Law 51.532F1,W1 or S1
Feminism, Law and Social Transformation
This course addresses the nature and possibilities of
feminist engagement with law and the legal pro-
cess. Policies and strategies of law reform and/or
social transformation are formulated and evaluated
through the application of theoretical frameworks to
particular topics. The significance of the Canadian
Charter of Rights and Freedoms is examined, together
with human rights legislation.

• Law 51.535F1,W1 or S1
Crime, Social Change and Criminal Law Reform
This course examines the ideological and practical
consequences of criminal law reform and policy
initiatives undertaken by the state. Specific criminal
justice reform proposals are examined in order to
illustrate not only the possible alternate responses
to social problems but also the varying effects of
these responses.

• Law 51.540F1,W1 or S1
Law, Economy and the Regulatory Process
This course addresses the relationship between law,
the economy and the regulatory process. The focus
is on understanding the choice of regulatory models
from a political and economic perspective, and the
impact of different theories of regulation on
regulatory practice and enforcement. Selected topics
for investigation may be drawn from the areas of
labour law, housing and consumer protection, envi-
ronmental protection and anti-combines legislation.

• Law 51.545F1, W1 or S1
Canadian Labour Law Policy from a Comparative
Perspective
This course examines some major influences on the
formation of Canadian labour law policy. A
comparative perspective is used to highlight the
divergencies in Western democratic nations. It
questions whether Canadian labour law is distinctive,
and if so, the reasons for this distinctiveness. The
term "labour law" refers to both collective bargaining
and the regulation of individual employment
relationships through common law and statute.

Specific examples of labour law policy are high-lighted to consider their distinctiveness/sameness and to ask what forces may have led to specific policies.

• Law 51.550F1, W1 or S1
The Canadian Constitution
A highly concentrated half course, designed to familiarize graduate students with the terminology, principles, and doctrines of judicial interpretation of the *Constitution Acts 1867-1982* and other constitutional statutes. The emphasis will be on the division of legislative powers in the Canadian federation. This course or its equivalent is a pre-requisite for the course Law 51.553: Advanced Legal Problems of Federalism.
Prerequisite: Open only to graduate students in their master's year who have not previously studied Canadian constitutional law.

• Law 51.553F1, W1 or S1
Advanced Legal Problems of Federalism
An advanced study of selected Canadian constitu-tional problems including constitutional revision. Some comparisons with other federal systems may be made.
Prerequisite: A course in Canadian constitutional law, for example Law 51.550 or permission of the Department.

• Law 51.556F1, W1 or S1
Advanced Administrative Law Problems
An in-depth study of selected legal questions involving the activities of public authorities.
Prerequisite: A course in administrative law or permission of the Department.

• Law 51.563F1, W1 or S1
International Law: Theory and Practice
This course is designed to give students an appreciation of various theoretical perspectives on international law, with a view to locating the role which inter-national law plays in the international system. Topics include the basis of international law, the creation and sources of international law, the utilization of international law in international dispute-resolution, and international law and world order transformation. Illustrative issues will vary according to the interests of students each year.
(Also offered as International Affairs 46.555)

• Law 51.590F1, W1 or S1
Tutorials/Directed Readings in Law
Tutorials or directed readings in selected areas of law, involving presentation of papers as the basis for discussion with the tutor.

• Law 51.591F1, W1 or S1
Tutorial/Directed Readings in Law
Tutorials or directed readings in selected areas of law, involving presentation of papers as the basis for discussion with the tutor.

• Law 51.593F1, W1 or S1
Contemporary Topics in Legal Studies
A research seminar which explores a selected topic from current debates in legal studies. Students should check with the Department regarding the topic offered.

• Law 51.594F1, W1 or S1
Contemporary Topics in Legal Studies
A research seminar which explores a selected topic from current debates in legal studies.
Students should check with the Department regarding the topic offered.
(Also offered as Sociology 53.586)

Selection of Courses in Related Disciplines

In addition to the graduate courses offered by the Department of Law, students in the M.A. program are encouraged to take at least one half course (0.5 credits) in a related discipline, in consultation with the supervisor of graduate studies. Courses offered by other academic units which can be taken towards the requirements of the M.A. in Legal Studies are listed below. This list is not exhaustive and is subject to change.

In certain circumstances (with the approval of the supervisor of graduate studies) up to one credit may be selected from among those offered at the 400 level.
Note: Students should be aware that the number of spaces in graduate courses offered by other depart-ments may be limited, and that registration may be conditional upon obtaining the prior approval of the department concerned. It is the student's responsi-bility to ensure that permission is obtained from the appropriate department prior to registering in any of the department's courses.

Students are advised that there is no guarantee that all of these courses will be offered in any given year, or in any given term. Full-credit courses are scheduled over two terms. Students should check the current University timetable to ensure course availability and schedule when planning their program.

Canadian Studies
12.510   Northern and Native Issues
12.520   Women's Studies

Economics

43.432	Competition Policy
43.533	Regulation and Public Enterprise
43.538	Law and Economics
43.543	Public Choice

Geography

45.541	Society and Space
45.544	Gender and Environments

History

24.459	Selected Problems in the History of Women and the Family: From the Industrial Revolution
24.532	Ontario in the Nineteenth Century
24.559	Women in Nineteenth- and Twentieth-Century North America and Britain
24.588	Historiography of Canada
24.688	Social History

International Affairs

46.511	Canada in the International Political Economy
46.535	International Bargaining and Negotiation: Theory and Practice
46.542	Territory and Territoriality
46.545	International Organizations in International Affairs
46.555	International Law: Theory and Practice
46.557	International Economic Law: Regulations of Trade and Investment
46.588	International Political Economy

Journalism and Communication

28.541	Journalism Law

Political Science

47.407	The Politics of Law Enforcement in Canada
47.413	The State in Advanced Capitalist Societies
47.509	Canadian Political Economy
47.511	Canadian Federalism
47.570	Basic Research Methods
47.573	Advanced Research Methods

Psychology

49.514	Psychology of Women
49.517	Psychology of Family Violence
49.523	Psychology and Human Services
49.546	Quasi-experimental Design and Evaluation Research

Public Administration

50.502	Political Economy of Regulation
50.523	Microeconomics for Management and Policy
50.536	Law of Public Authorities I
50.537	Law of Public Authorities II
50.551	Quantitative Methods I
50.552	Quantitative Methods II

50.567	Political Economy of the State
50.568	Policy and Decision Making
50.569	Public Choice: Theory and Application
50.584	Industrial Relations and Collective Bargaining
50.585	Public-sector Collective Bargaining

Social Work

52.503	Foundations of Sexuality
52.504	Social Work and the Law
52.506	Women and Welfare
52.508	Social Deviance and Social Control
52.510	History and Philosophy of Social Welfare
52.511	Social Policy Analysis
52.515	Poverty and Wealth
52.516	Women and Social Policy
52.517	Social Policies for Children
52.530	Social Change and Social Welfare
52.531	Social Work with People in Conflict with the Law

Sociology and Anthropology

53.453	Workshop in Criminology/Deviance
53.457	Workshop in Social Psychology
53.500	Classical Sociological Theory
53.502	Contemporary Sociological Theory
53.509	Philosophy of Social Science I
53.511	Research Design and Data Analysis
53.512	Statistical Methods I
53.513	Statistical Methods II
53.514	Multivariate Analysis
53.521	Comparative Methods in Social Research
53.530	Social Institutions I
53.532	The Labour Process
53.536	Cultural Studies
53.538	Feminist Analyses
53.540	Political Sociology
53.541	Proseminar in Anthropology I
53.544	Race, Ethnicity and Class in Contemporary Societies
53.545	Power and Stratification
53.549	The Politics of Social Movements and the State
53.567	Contemporary Theories of Crime and Social Regulation
53.568	Women and Work
53.589	The Logic of the Research Process

Institute of Political Economy

Loeb Building A818
Telephone: 788-7414
Fax: 788-2154

The Institute

Director of the Institute:
Wallace Clement
The Institute of Political Economy, established in
1989, developed out of the Graduate Summer School
of Political Economy, which was formed in 1983.
The summer school was built on the strong tradition
of interdisciplinary studies at Carleton, and on the
interests of numerous faculty at Carleton involved
in political economy. Distinguished international
scholars have been attracted to teach in the summer
school. Through the Institute, these distinguished
visitors will now be in residence during the normal
academic year, in addition to the summer program.

The Institute offers a program of study and research
leading to the degree of Master of Arts in Political
Economy, the only program of its kind in Canada.
Its interdisciplinary program is designed to offer
students both an exposure to the core concepts of
political economy and an opportunity to develop
individual areas of research concentration.

The program focuses on investigating the
relationship between the economy and politics as
they affect the social and cultural life of societies,
and secondly, focuses on the historical processes
whereby social change is located in the interaction
of the economic, political, cultural and ideological
moments of social life.

Carleton University has developed a strong tradi-
tion in political economy. Faculty members from
most of the social sciences and history participate
regularly in the Institute. The program's curriculum
includes courses with a political economy orientation
that are offered by other departments, schools, and
institutes. The Master of Arts in Political Economy
is an opportunity for students to study political
economy from the perspective of different disciplines
within a single program.

Qualifying-Year Program

Applicants who have a general (pass) bachelor's
degree in one of the disciplines represented in the
program may be admitted to a qualifying-year
program designed to raise their status to that of
honours graduates. Students are expected to achieve

at least high honours in qualifying-year courses in
order to be considered for admission to the master's
program. To be eligible for admission to a qualifying
year, normally a student must previously have
successfully completed at least four courses in one
of the social sciences.

Refer to the general section of the calender for
details of the regulations governing qualifying year.

Master of Arts

Admission Requirements
The normal requirement for admission to the master's
program is an honours B.A. with at least high honours
standing in one of the disciplines represented in the
Institute. Prospective applicants without such
qualifications may be considered for admission if
they have both a strong academic record and
relevant work experience. Such students normally
are asked to complete a qualifying year of study with
at least high honours standing before proceeding to
the master's program.

Program Requirements
The Master of Arts in Political Economy is a
five-credit program, one of which may be at the
400 (honours undergraduate) level. Each candidate,
in consultation with the Institute, must select and
follow one of two optional patterns:
- Three full courses or the equivalent, a thesis worth
  two credits, and an oral examination of the thesis
- Four full courses or the equivalent, a research
  essay worth one credit, and an oral examination
  of the research essay

Whichever pattern is selected, all Institute students
are required to take Political Economy 44.500:
Theories of Political Economy, and 44.501: The
Methodology of Political Economy, two half-credit
seminars offered by the Institute.

As well, students must select at least *one* half
credit from the following; Sociology 53.525:
Canadian Society, *or* Political Science 47.509:
Canadian Political Economy, *or* International Affairs
46.588: International Political Economy, *or* Political
Science 47.588: International Political Economy, *or*
approved equivalents of these courses. Registration
in these courses is contingent upon the completion
of all prerequisites or, in exceptional cases, obtaining
the permission of the relevant department or school.
The base course pattern annually available to students
would normally be:

Fall Term
- Political Economy 44.500: Theories of Political Economy
- *One* of: Sociology 53.525: Canadian Society, *or* Political Science 47.509: Canadian Political Economy *or* International Affairs 46.588: International Political Economy, *or* Political Science 47.588: International Political Economy
- Political Economy 44.551: Selected Problems in Political Economy I (one half-credit course taught by the visiting professor of the Institute of Political Economy)

Winter Term
- Political Economy 44.501: Methodology of Political Economy
- *One* of: Sociology 53.525: Canadian Society, *or* Political Science 47.509: Canadian Political Economy *or* International Affairs 46.588: International Political Economy, *or* Political Science 47.588: International Political Economy
- Political Economy 44.552: Selected Problems in Political Economy II (one half-credit course taught by the visiting professor of the Institute of Political Economy)

Summer Term
- Political Economy 44.551: Selected Problems in Political Economy I and Political Economy 44.552: Selected Problems in Political Economy II (two half-credit courses taught by the visiting professor of the Institute of Political Economy and two half-credit courses contributed by participating departments).

Academic Standing

All master's candidates must maintain at least B standing (grade point average of 8.0). A candidate may, with the recommendation of the Institute and the approval of the Dean of the Faculty of Graduate Studies and Research, be allowed a grade of C+ in one full-credit course.

Graduate Courses*

The Institute's courses will not normally be open to undergraduate students.

- Political Economy 44.500F1,W1,S1
Theories of Political Economy
A survey of the evolution of the core concepts and ideas proposed by both the founders and modern practitioners of the various approaches to political

* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

economy. Particular attention will be paid to contemporary theorists as well as classical theorists such as Smith, Ricardo, Marx, Mill, Schumpeter, Keynes, Veblen, and Innis.

- Political Economy 44.501F1,W1,S1
The Methodology of Political Economy
An examination of the methods, procedures, and rules for developing theory and guiding inquiry in political economy research, including topics such as logic of inquiry, conceptualization, research design, dialectics, level of analysis, comparison, evidence and statistics.

- Political Economy 44.551F1,W1,S1
Selected Problems in Political Economy I
(Also offered as Sociology 53.554 and Political Science 47.551)

- Political Economy 44.552F1,W1,S1
Selected Problems in Political Economy II
(Also offered as Sociology 53.555 and Political Science 47.552)

- Political Economy 44.590F1,W1,S1
Tutorial in Political Economy
A course of directed readings on selected aspects of political economy, involving preparation of papers as the basis for discussion with the tutor. Offered when no regular course offering meets a candidate's specific needs.
Prerequisite: Permission of the Director.

- Political Economy 44.598F2,W2,S2
Research Essay
Directly linked to the student's course work, the research essay must be interdisciplinary in approach.

- Political Economy 44.599F4,W4,S4
M.A. Thesis
The thesis is an alternative to the research essay. It must also be interdisciplinary in approach, and requires greater substance and originality than the Research Essay. Normally, a student's thesis committee will be composed of members from more than one discipline.

Selection of Courses

In addition to the graduate courses offered by, or associated with, the Institute, the courses listed below are of relevance to students of political economy and would, with the prior approval of the Institute, be used to design a coherent and internally complementary set of courses to fulfil degree requirements. The list is *not exclusive* and is subject to change. Moreover, students may select one full course (or equivalent) in political economy that is offered at the 400 level.

Note: Students should be aware that the number of spaces in graduate courses offered by other departments may be limited, and that registration may be conditional upon obtaining the prior approval of the department concerned. It is the student's responsibility to ensure that permission is obtained from the appropriate department prior to registering in any of the following courses.

The Institute expects to attract high quality graduate students who will be likely to continue to a second post-graduate degree. Given that a Ph.D. program in political economy does not exist, master's students will be directed to consult with the department where they might wish to pursue doctoral studies so that they may select courses that will prepare them for this next stage.

Business
42.530 Managing the Multinational Enterprise
42.531 Seminar in International Business Management

Canadian Studies
12.510 Northern and Native Issues
12.520 Women's Studies
12.530 Canadian Culture and Cultural Policy

Economics
43.511 Canadian Economy I
43.521 History of Economic Thought I
43.533 Regulation and Public Enterprise
43.538 Law and Economics
43.541 Public Economics: Expenditure
43.542 Public Economics: Taxation
43.543 Public Choice
43.544 Fiscal Federalism
43.550 Theory of Economic Development
43.554 Economic Development: Internal Aspects
43.555 Economic Development: International Aspects
43.586 Comparative Economic Systems I
43.587 Comparative Economic Systems II
43.607 Research Methods in Economics

Geography
45.427 Urban Development and Analysis
45.520 Issues in Development in Africa
45.540 Territory and Territoriality
45.541 Society and Space
45.544 Gender and Environments

History
24.421 Science and Technology in the Canadian Experience
24.422 The Maritimes in Transition, 1840s to 1890s
24.425 Selected Problems in the Political Economy of Canadian Labour
24.431 Canada from Confederation to the Great War
24.433 Selected Problems in Canadian Business 1850-1980
24.437 Canada from War to War
24.439 Modern Canada since 1939
24.458 Selected Problems in Nineteenth- and Twentieth-Century British Social History
24.459 Selected Problems in the History of Women and the Family: from the Industrial Revolution
24.471 Selected Problems in International Economic History
24.525 Society and Culture in Canada, 1850-1939
24.530 Canadian Immigration and Ethnic History
24.532 Ontario in the Nineteenth Century
24.534 Problems of Growth and War in Canada, 1896-1921
24.536 Science and Technology in the Canadian Experience
24.537 The Maritimes in Transition, 1870s to 1920s
24.558 Reform and Society in Mid-Nineteenth Century Britain
24.559 Women in Nineteenth- and Twentieth-Century North America and Britain

International Affairs
46.511 Canada in the International Political Economy
46.541 The International Economics and Politics of Resources
46.561 Historical Dimensions of Development and Underdevelopment
46.564 Issues in Development in Latin America
46.567 Issues in Development in Southeast Asia
46.580 Pacific Economic and Political Relationships
46.582 The Political Economy of East-West Relations
46.583 Political Economy of Eastern Europe

Law
51.401 Law, Family and Gender
51.402 Feminist Theories of Law
51.403 Historical Perspectives on Law, Economy and Society
51.405 Contemporary Theories of Law, State and Politics
51.502 Law and Gender Relations
51.503 Law, Economy and Society
51.504 Law, Crime and Social Order
51.505 Law, State and Politics
51.506 Historical Perspectives on Law and Society
51.507 Race, Ethnicity and the Law

Department of Political Science

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The Department

Chair of the Department:
J.H.Pammett
Departmental Supervisor of Graduate Studies:
S.E. Bennett
Assistant Supervisor:
B.L. Jenkins

The Department offers programs leading to the M.A. and Ph.D. degrees. Specialized graduate study and research may be undertaken in the fields of political theory, Canadian government and politics, comparative government and politics, international relations, and public administration and policy analysis. Within these fields, students may select more specialized areas of concentration, such as classical, medieval and modern, or analytic and empirical theory; comparative government and politics of a particular area or group of countries where the Department has developed particular strength and resource materials.

Ottawa provides a wealth of resources, both in personnel and in research material, for the student of government, politics, public administration, and international relations. Carleton has specialized schools and institutes for interdisciplinary study in public administration, Canadian studies, international affairs, and post-Soviet and East European studies. In addition to the university facilities, Ottawa offers the graduate student in political science a host of study and research opportunities unparalleled in Canada. The Public Archives, the National Library, the Library of Parliament, the Supreme Court Library, the National Museums, and Statistics Canada are all located in Ottawa. The headquarters of many government departments, most federal government agencies, and a multitude of national organizations and trade associations are located in Ottawa; many maintain specialized libraries. Some of the embassies and diplomatic missions located in Ottawa maintain specialized libraries, and offer access to documents and other research materials.

Qualifying-Year Program

Applicants who have a general (pass) B.A. in Political Science, with second-class standing, may be considered for admission to a qualifying-year program. Candidates who complete the qualifying year with high honours standing may be considered for admission to the master's program the following year.

Refer to the general section of this calendar for details of the regulations governing the qualifying year.

Master of Arts

Admission Requirements
The normal requirement for admission to the master's program is an honours B.A. (or the equivalent) in Political Science, with at least high honours standing.

Honours graduates in fields other than political science will be considered on the basis of their academic background and standing. Those with deficiencies may be required to take additional courses or to register in the qualifying-year program.

Program Requirements
All master's candidates will enrol in an approved number of courses in political science, including political theory and research methodology, if not already taken. No more than one of these courses may be taken at the 400 level.

Each candidate, in consultation with the Department, will select and follow one of the following three optional program patterns:
- Five full courses (or the equivalent) in political science
- Four full courses (or the equivalent) in political science, and a research essay on a topic related to one of the courses
- Three full courses (or the equivalent) in political science, and a research thesis, equivalent to two full courses, in an approved field

All master's candidates in political science must also undertake comprehensive examinations on approved fields. Details of these examinations are outlined in the section on comprehensive examinations.

All candidates must normally demonstrate a reading knowledge of French. Students from abroad, whose mother tongue is other than English, or students whose research interests require another language,

may obtain permission from the departmental graduate studies committee to substitute this language for French. Language tests are conducted twice a year, in October and February.

A supervisor will be assigned to each candidate to advise and assist in the preparation for the comprehensive and language examinations.

Comprehensive Examinations

Those master's candidates electing a five-course program will be required to take a comprehensive examination, orally or in writing, on an approved major and allied field. The major field of concentration will be chosen from the following:

- Political Theory
- Canadian Government and Politics
- Comparative Government and Politics
- International Relations
- Public Administration and Policy Analysis

Comprehensive examinations normally will be undertaken no later than the term immediately following the completion of course work for the master's degree. Those master's candidates electing the four course plus research essay, or three-course plus thesis options, will be required to defend the essay or thesis at an oral examination. This examination may include material related to the general field of the essay or thesis.

Academic Standing

All master's candidates must obtain at least B standing (grade point average 8.0). One grade of C+ may be allowed.

Doctor of Philosophy

The Ph.D. program in political science normally will be undertaken on a full-time basis. However, in cases of exceptional merit, the Department will accept a few candidates for the degree on a part-time basis.

Admission Requirements

The normal requirement for admission to the Ph.D. program is a master's degree (or its equivalent) in political science, public administration, or international affairs, with at least high honours standing. This normally will mean a Carleton equivalent grade point average of 9.5, taking into account both transcript and letters of reference.

Program Requirements

The normal program requirements for Ph.D. candidates are outlined in the general regulations section of this calendar.

All students are required to have or to acquire an adequate basic knowledge of political theory and research methodology, regardless of their field of specialization. If statistical proficiency is needed

for the preparation of their thesis, students will also be expected to undertake further work in statistics. The specific program requirements for Ph.D. candidates in political science are the following:

- At least three graduate full courses or the equivalent; a grade point average of at least 9.0 must be obtained in these courses before proceeding to the comprehensive examinations. Additional courses may be required for candidates whose background or standing is deficient. Students are encouraged to take additional courses for credit or audit, beyond the minimum requirement of three, in order to prepare for comprehensive examinations in areas of specialization in each of their fields
- Program options for Ph.D. field selections: *either* two major fields with two subfields in each, *or* a major field with two subfields and two minor fields with a subfield in each; that is, a choice of one of two program options: Political Science 47.690 and 47.695, *or* Political Science 47.690, 47.691, and 47.692
- Proficiency in languages, and/or research skills, as outlined below under language and research skill requirement
- Comprehensive examinations, as outlined below under comprehensive examinations
- A thesis, written in English or French, which must be defended in English at an oral examination; this examination may include material related to the general field of the thesis

The completion of the Ph.D. course work and comprehensive examinations will normally require at least two years of full-time study beyond the master's degree.

Normally a thesis proposal will be submitted to and approved by members of the thesis committee within six months of the oral comprehensive examination.

A faculty member will be assigned to each Ph.D. candidate to advise him/her on his/her studies. The student's entire program must be approved by the Department.

Language and Research Skill Requirement

All Ph.D. candidates must demonstrate an ability to use two research skills appropriate to their program, one of which must be a language other than English.

Candidates, one of whose major fields is Canadian government and politics, or whose thesis deals mainly with Canada, must demonstrate an ability to read and translate French easily as one of their skill requirements.

All other candidates must demonstrate an ability to read and translate easily a language appropriate to their program.

The second skill requirement for all students may be fulfilled in one of the following ways:
- A demonstrated ability to read and translate easily a second language
- An oral knowledge of a language sufficient to conduct interviews in the language
- Satisfactory completion (B- or better) of *two* of Political Science 47.571: Intermediate Polimetrics for Micro Data; Political Science 47.572: Intermediate Polimetrics for Macro Data; Political Science 47.573: Advanced Research Methods
- Credit work in an approved political science methodology workshop or colloquium

The research skill requirement shall *normally* be satisfied before the thesis proposal defence.

Comprehensive Examinations

All Ph.D. candidates must select one of the two options below:
- A written examination in two major fields covering general knowledge of the field; examination in two approved areas of specialization in each field, the form of examination to be determined by the supervisory committee in conjunction with the supervisor of graduate studies
- A written examination in one major field covering general knowledge of the field, and examinations in two approved areas of specialization; a written general examination in two minor fields, and examination in one approved area of specialization in each. The form of examination in areas of specialization will be determined by the supervisory committee in conjunction with the supervisor of graduate studies

In addition, candidates must undertake a final oral comprehensive examination integrating the fields.

The comprehensive examinations will normally be completed by the beginning of the seventh term of registration. Candidates will be expected to complete these examinations successfully before beginning the thesis. The fields of study for the Ph.D. examinations are to be chosen from the following list:

Political Theory
A general knowledge of the main outlines and significant themes and problems of political philosophy and thought, with emphasis on two of the following: classical (mainly Greek and Roman); medieval political thought; modern (from the sixteenth century); political ideologies (nineteenth and twentieth centuries); Canadian and American political thought and its immediate European background (if Canadian political thought and ideology is not chosen as a subfield under Canadian); current theories and approaches to political analysis; quantitative theory and method.

Canadian Government and Politics
A general knowledge of Canadian political ideas, institutions, and processes, with emphasis on two of the following: federalism, and the Constitution; parliament and legislatures; parties, elections, and interest groups; political culture and socialization; political economy; provincial government and politics; local government and politics; public administration (if not chosen as a subfield under public administration and policy analysis); public policy and policy analysis (if not chosen as a subfield under public administration and policy analysis); foreign policy and relations (if Canada is not chosen as the particular state under international relations); Canadian political thought and ideology (if not chosen as a subfield under political theory).

Comparative Government and Politics
A general knowledge of the theories and methodology of comparative politics, with emphasis on one subfield from each of the following two lists:
- Countries or areas: Western Europe; former USSR and/or Eastern Europe; United States; Latin America; Africa; Asia; or an approved combination of countries or areas
- Topics or themes: the state and society; institutions; development; revolution and social movements; nationalism; politics of multiculturalism and ethnicity; political behaviour; federalism; local government and politics; gender and politics; or an approved topic or theme

International Relations
A general knowledge of international theory, international organization, and the development of the field of international relations, with specialization in two of the following: analytical international theory; Canadian foreign policy (if this subfield is not chosen in Canadian government and politics); comparative analysis of foreign policy (including a knowledge of a particular state or region); international integration and organization; conflict and conflict resolution (including arms control and international negotiation); international political economy.

Public Administration and Policy Analysis
A general knowledge of theory and practice with emphasis on two of the following topics:
1) theories of administration, organization, comparison, and policy analysis, 2) Canadian public administration (including some knowledge of provincial and municipal levels), 3) Canadian public policy and policy analysis (including some knowledge of provincial and municipal levels), 4) comparative public administration (with reference to developed or developing countries, or

an approved combination of countries), 5) comparative public policy and policy analysis (with reference to developed or developing countries, or an approved combination of countries), 6) administrative responsibility (including judicial controls).

Candidates may not select both subfields 2 and 3 and may not select any of subfields 2, 3, or 4 in combination with the corresponding subfields in the main fields of Canadian Government and Politics and Comparative Government and Politics. For example, a candidate may not select the Canadian subfield "public administration" and the Public Administration subfield "Canadian public administration".

Selection of Courses

Within the scope of the regulations, the following undergraduate courses (fully described in the Carleton University *Undergraduate Calendar*) may be taken by graduate students.

Please note that not all of these courses are offered every year. Students should consult the timetable published each year in early June.

Political Science

47.400	Topics in Canadian Government and Politics
47.402	Policy Seminar: Problems of Northern Development
47.403	Politics and the Media
47.405	Federalism
47.406	Legislative Process in Canada
47.407	The Politics of Law Enforcement in Canada
47.408	National Security and Intelligence in the Modern State
47.409	Politics in Quebec
47.410	Canadian and Comparative Local Government and Politics
47.411	French-English Relations
47.412	Politics of Western Liberal Democracies
47.413	The State in Advanced Capitalist Societies
47.414	Theory and Practice in Third World Development
47.415	Selected Problems in Third World Development
47.416	Labour and the Canadian State
47.417	Political Participation in Canada
47.418	Canadian Provincial Government and Politics
47.419	The Politics of the Canadian Charter of Rights and Freedoms
47.420	Policy Making in the United States
47.421	Politics of Influence in the United States

47.422	Constitutional Politics
47.431	Marxist Thought
47.432	Contemporary Marxism
47.434	Political Inquiry
47.435	Contemporary Political Theory
47.436	Concepts of Political Community I
47.437	Concepts of Political Community II
47.441	Business-Government Relations in Canada
47.448	Public Organizations: Theory and Practice
47.460	Analysis of International Politics
47.461	Foreign Policies of Soviet Successor States
47.463	Analysis of International Political Economy
47.464	Selected Problems in International Political Economy
47.466	American Foreign Policy
47.467	International Politics of North America
47.482	International Politics of Africa
47.483	Foreign Policies of Major East Asian Powers
47.484	International Relations of South and South-East Asia

Students are encouraged to look at the course offerings of the Departments of Sociology and Anthropology, Economics, and Geography, the Schools of International Affairs, Public Administration, and Social Work and the Institutes of Political Economy and Central/East European and Russian-Area Studies and other related disciplines at Carleton.

Except where an M.A. student is permitted to take an allied field in another discipline, a graduate student will normally take no more than one course in another department, school, or institute, in fulfilment of the M.A. or Ph.D. requirements.

Graduate Courses*

The following is a complete list of all political science graduate-level courses. Students should consult the timetable (published in early June) for a list of courses which will be offered during 1994-95. Enrolment in graduate courses requires the permission of the Department, through the supervisor of graduate studies.

• Political Science 47.503F1 or W1
Political Parties in Canada
A seminar on political parties and party systems in Canadian federal politics, including an examination of patterns of historical development, party

* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

organization and finance, relationships with social movements, and the impact of Canadian federalism.

• Political Science 47.504F1 or W1
Policy Making in Canada
A study of the main policy-making actors, structures, and influences at the federal level, such as the cabinet, the bureaucracy, the central and advisory agencies, parliament, parties, interest groups, élites, secrecy and the press. Some attention will also be given to the provincial level and to the process of federal-provincial bargaining.

• Political Science 47.506F1 or W1
Problems of Canadian Government and Politics I
A research seminar on selected problems.

• Political Science 47.507F1 or W1
Problems of Canadian Government and Politics II
A research seminar on selected problems.

• Political Science 47.508F1 or W1
The Politics of Energy and the Environment
A research seminar focusing upon the substantive issues, the policy structures and processes, and current Canadian governmental response in the area of energy policy and environmental quality management.

• Political Science 47.509F1 or W1
Canadian Political Economy
A seminar on political economy as a traditional and contemporary approach to the study of Canadian politics and the Canadian state. Canada's economic development, social relations (including gender and race relations), and position in the international political economy will be explored.

• Political Science 47.511F1 or W1
Canadian Federalism
A study of the evolution and contemporary operation of the Canadian federal system, noting particularly the specific social, political, economic, and structural features which underlie its operational performance, its resilience in crisis, and its potential for adaptation.

• Political Science 47.514F1 or W1
The Transition from Communism
An in-depth investigation of the problems of transition in post-communist societies. Seminar three hours a week.

• Political Science 47.515F1 or W1
Post-Communist Politics in East Central Europe
A comparative examination of the emergence of post-communist political systems in East Central Europe. Seminar three hours a week.

• Political Science 47.516F1 or W1
Selected Problems in the Politics of Soviet Successor States
A seminar on selected problems of nation-building in Russia, Ukraine, and other Soviet successor states. Seminar three hours a week.

• Political Science 47.517F1 or W1
Selected Problems in African Politics
A political economy approach will be taken in this seminar, stressing the relationship of dependence, underdevelopment, participation, and class formation to the decision-making process in selected countries.

• Political Science 47.518F1 or W1
State, Revolution, and Reform in East Asia
Problems of state-building, political institutions, and policy making in the sinitic world, including the People's Republic of China, Taiwan, Japan, North and South Korea, and Vietnam.

• Political Science 47.519F1 or W1
Comparative Public Policy
A review of approaches to the study of policy, of the impact of political factors on policy, and of the substance of policy choices in such domestic fields as communications, social security, health, industrial and rural development policies in selected countries.

• Political Science 47.520F1 or W1
Nationalism
A seminar on the historical and comparative study of nationalism, with emphasis on its role in the promotion of political change.

• Political Science 47.521F1 or W1
Politics in Plural Societies
A seminar on politics in multicultural societies, with emphasis on Canada and other developed democracies. Topics will include structural segmentation, consociational processes, intergroup attitudes, and institutional adjustments to pluralism.

• Political Science 47.522F1 or W1
Politics of Third World Development
A seminar examining the politics of development and underdevelopment in the Third World. Topics covered will include theory, selected issues, and case studies from Africa, Asia, and Latin America.

• Political Science 47.523F1 or W1
The Politics of Southern Africa
This course will examine the roots of the contemporary political situation in the countries of Southern Africa and competing explanations in the literature. Seminar three hours a week.

Also offered at the undergraduate level, with different requirements, as 47.423, for which additional credit is precluded.

• Political Science 47.525F1 or W1
Problems in American Government I
A research seminar on topics such as the distribution of power, decision-making processes, the impact of technology, strains in intergovernmental relations, civil-military relations, governmental news management and secrecy; executive accountability, and impediments to reform of Congress and the presidency.

• Political Science 47.526F1 or W1
Problems in American Government II
A research seminar on topics such as political violence and social change, the roles of mass media, business élite roles, political corruption, civil rights and minority politics, and the urban crisis.

• Political Science 47.531F1 or W1
Modern Political Culture and Ideology
This seminar explores certain connections among image, symbol, myth, language and politics. Topics include the expressive and designative conceptions of language; myth, metaphor and the foundations of civic life; rhetoric and the *sensus communis*; romanticism and nationalism; myth in democratic and totalitarian politics; and the structure of political culture.

• Political Science 47.532F1 or W1
Democratic Theories
Analysis of various theories of democracy and community, from classical to modern.

• Political Science 47.536F1 or W1
The Canadian and American Political Traditions I
A seminar on the interpretation of the American, English-Canadian, and French-Canadian political traditions. The emphasis will be on English-Canadian and French-Canadian political traditions. Students who have completed 47.535 may not take 47.536 for credit.

• Political Science 47.537F1 or W1
The Canadian and American Political Traditions II
A seminar on the interpretation of the American, English-Canadian, and French-Canadian political traditions. The emphasis will be on the American political tradition. Students who have completed 47.535 may not take 47.537 for credit.

• Political Science 47.541F1 or W1
Canadian Public Administration and Policy Analysis
The theory and practice of public administration in Canada, with emphasis on the federal level, including the role of the bureaucracy in policy making.

• Political Science 47.544F1 or W1
Public Administration in Developed Western Countries
A seminar in comparative public administration, with emphasis on Commonwealth countries, the United States, France, and West Germany.

• Political Science 47.545F1 or W1
Public Administration in Developing Countries
A seminar on the literature and characteristics of development administration; comparison by region, country, and topic.

• Political Science 47.548F1 or W1
Research Seminar in Public Administration I
The content of this seminar will vary from year to year according to faculty research interests and student demand.

• Political Science 47.549F1 or W1
Research Seminar in Public Administration II
The content of this seminar will vary from year to year according to faculty research interests and student demand.

• Political Science 47.551S1
Selected Issues in Political Economy I
A research seminar exploring a selected topic of current research having a political economy perspective, such as power and stratification; dynamics of state action; contrasting views on administration as an instrument of political economy; culture, ideology, and social relations; and the labour process.

• Political Science 47.552S1
Selected Issues in Political Economy II
A research seminar exploring a selected topic of current research having a political economy perspective, such as power and stratification; dynamics of state action; contrasting views on administration as an instrument of political economy; culture, ideology, and social relations; and the labour process.

• Political Science 47.553F1 or W1
Selected Problems in Western European Politics I
This course is designed to deal intensively with domestic politics in Britain, France, Germany, Italy, and selected minor European powers. Students who have completed 47.550 may not take 47.553 for credit.

• Political Science 47.554F1 or W1
Selected Problems in Western European Politics II
This course is designed to deal intensively with comparative and supra-national issues concerning the European Community, NATO, and other Western European institutions. Students who have completed 47.550 may not take 47.554 for credit.

• Political Science 47.555F1 or W1
Selected Problems of Comparative Politics I
A research seminar which will deal with a central
theme of current research in comparative politics,
such as: the effects of state policy and expenditure;
technology and politics; political psychology;
sex/gender and politics; the military and politics;
Marxism and politics; religion and politics; studies
in revolution; comparative parties and interest groups.

• Political Science 47.556F1 or W1
Selected Problems in Comparative Politics II
A research seminar which will deal with a central
theme of current research in comparative politics,
such as: the effects of state policy and expenditure;
technology and politics; political psychology;
sex/gender and politics; the military and politics;
Marxism and politics; religion and politics; studies
in revolution; comparative parties and interest
groups.

• Political Science 47.561F1 or W1
Analysis of Canadian Foreign Policy
A research seminar on contemporary Canadian
external policies, with emphasis on the analysis of
cases and issues, and comparisons with other national
actors.

• Political Science 47.570F1 or W1
Basic Research Methods
A course for graduate students with no background
in research methods. Content: basic statistics and
applications.

• Political Science 47.571F1 or W1
Intermediate Polimetrics for Micro Data
This course covers intermediate research de-
signs and statistical techniques primarily used in
analyzing survey data. Selected topics may vary
from year to year. Students intending to do research
based on micro data are advised to take this course.
Also offered at the undergraduate level, with differ-
ent requirements, as 47.471, for which additional
credit is precluded.
Prerequisite: Political Science 47.570 or permission
of the Department.

• Political Science 47.572F1 or W1
Intermediate Polimetrics for Macro Data
This course covers intermediate research designs
and statistical techniques primarily used in ana-
lyzing macro or aggregate data. Selected topics
may vary from year to year. Students intending
to do research based on macro data are advised to
take this course. Also offered at the undergraduate
level, with different requirements, as 47.472, for
which additional credit is precluded.
Prerequisite: Political Science 47.570 or permission
of the Department.

• Political Science 47.573F1 or W1
Advanced Research Methods
A course in advanced techniques of analysis. The
focus of this research seminar is the use of various
mathematical and statistical techniques in the
construction and analysis of political theory. The
seminar may include such topics as the translation
of verbal theory into formal theory, the use of sta-
tistical techniques beyond regression and corre-
lational analysis to examine political hypotheses,
and index construction, including scaling and val-
idation techniques.
Prerequisite: Political Science 47.570 or permission
of the Department.

• Political Science 47.581F1 or W1
Foreign Policies of African States
The foreign policy determinants and international
behaviour of African states. Each year, the seminar
will focus on a particular issue area. Students
who have completed 47.482 may not take 47.581
for credit except by permission of the Department.

• Political Science 47.585F1 or W1
Foreign Policy Analysis
A research seminar dealing with selected problems
in the study of foreign policy formulations and
outcomes.

• Political Science 47.586F1 or W1
Strategic Thought and Issues in International
Security
A research seminar on the evolution of classical and
contemporary strategic thought, as well as on cur-
rent issues in international security. Seminar
three hours a week.

• Political Science 47.587F1 or W1
Analysis of International Organizations
A research seminar on process and change in
contemporary forms of international organization.

• Political Science 47.588F1 or W1
International Political Economy
A seminar on the changing international division of
labour, and its consequences for world politics.
Topics include differing patterns of industrial-
ization, colonial relations, the role of the state,
and current issues in international political economy.
Prerequisite: Work at a senior undergraduate level
is required in at least two of the following: inter-
national relations, development studies, interna-
tional trade, or political economy (or permission of
the Department).
(Also offered as International Affairs 46.588)

• Political Science 47.589F1 or W1
Problems in International Politics
A workshop on significant issues in the study of international politics, with emphasis on the state of the field (and subfields) and problems in research. *Prerequisite:* Political Science 47.560 or 47.660 and 47.661, or permission of the Department.

• Political Science 47.590T2
Tutorial in a Selected Field
Tutorials or reading courses on selected topics may be arranged with the permission of the Department.

• Political Science 47.591F1, W1, S1
Tutorial in a Selected Field
Tutorials or reading courses on selected topics may be arranged with the permission of the Department.

• Political Science 47.594F1, W1, S1
M.A. Comprehensive Tutorial
Tutorial designed as preparation for the M.A. comprehensive examination, under the direction of members of the Department. The grade to be awarded will be that obtained on the comprehensive examination.

• Political Science 47.598F2, W2, S2
M.A. Research Essay
Tutorial for students who write a research essay rather than a thesis.

• Political Science 47.599F4, W4, S4
M.A. Thesis

Please note that courses numbered 47.600 through 47.661 are open to both M.A. and Ph.D. students.

• Political Science 47.600F1
The Political Process in Canada I
An analytical study of the democratic political process, with particular reference to political parties and elections, pressure groups, and political leadership in Canada. Students who have completed 47.510 may not take 47.600 for credit.

• Political Science 47.601W1
The Political Process in Canada II
An analytical study of the democratic political process, with particular reference to political parties and elections, pressure groups, and political leadership in Canada. Students who have completed 47.510 may not take 47.601 for credit.

• Political Science 47.615F1
Comparative Politics I
A research seminar dealing with theories, methods, and problems of comparison. Students who have completed 47.505 may not take 47.615 for credit.

• Political Science 47.616W1
Comparative Politics II
A research seminar dealing with particular themes. Students who have completed 47.505 may not take 47.616 for credit.

• Political Science 47.630F1
Political Theory I
An intensive examination of the major questions in classical, medieval, modern, and contemporary political philosophy. This political theory course is both historically comprehensive in scope and thematically oriented in depth. Students who have completed 47.530 may not take 47.630 for credit.

• Political Science 47.631W1
Political Theory II
An intensive examination of the major questions in classical, medieval, modern, and contemporary political philosophy. This political theory course is both historically comprehensive in scope and thematically oriented in depth. Students who have completed 47.530 may not take 47.631 for credit.

• Political Science 47.646F1
Theories of Public Administration
A seminar on theories of bureaucracy, organization, and comparison.
Also offered at the undergraduate level, with different requirements, as 47.446, for which additional credit is precluded.

• Political Science 47.647W1
Public Policy: Content and Creation
This course provides an opportunity to examine and apply major perspectives on the content and creation of public policy. The focus is on the explanation, prediction and design of policy. Perspectives and examples are drawn from a variety of frameworks and from both Canadian and non-Canadian contexts.
Also offered at the undergraduate level, with different requirements, as 47.447, for which additional credit is precluded.

• Political Science 47.660F1
Theory and Research in International Politics I
An examination of the principal problems in contemporary international relations theory and research, emphasizing the state of the field and current directions in it. Students who have completed 47.560 may not take 47.660 for credit.

• Political Science 47.661W1
Theory and Research in International Politics II
An examination of the principal problems in contemporary international relations theory and research, emphasizing the state of the field and

current directions in it. Students who have completed 47.560 may not take 47.661 for credit.

- Political Science 47.690F3, W3, S3
Ph.D. Tutorials

Ph.D. tutorials specifically designed as intensive preparation for the major field examinations, under the direction of one or more members of the Department. The grade to be awarded will be that obtained on the field examination.

- Political Science 47.691F3, W3, S3
Ph.D. Tutorials

Ph.D. tutorials specifically designed as intensive preparation for the minor field examinations, under the direction of one or more members of the Department. The grade to be awarded will be that obtained on the field examinations.

- Political Science 47.692F3, W3, S3
Ph.D. Tutorials

Ph.D. tutorials specifically designed as intensive preparation for the minor field examinations, under the direction of one or more members of the Department. The grade to be awarded will be that obtained on the field examinations.

- Political Science 47.695F3, W3, S3
Ph.D. Tutorials

Ph.D. tutorials specifically designed as intensive preparation for the major field examinations, under the direction of one or more members of the Department. The grade to be awarded will be that obtained on the field examination.

- Political Science 47.699F10, W10, S10
Ph.D. Thesis

Ph.D. students in political science at Carleton University may also seek supervision from the faculty of related schools and departments, particularly the Schools of Public Administration and Social Work, the Norman Paterson School of International Affairs, the Departments of Economics, Geography and Sociology and Anthropology, and the Institutes of Political Economy and Central/East European and Russian-Area Studies.

Department of Psychology

Loeb Building B552
Telephone: 788-2644
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The Department

Chair of the Department:
W.D. Jones
Departmental Supervisor of Graduate Studies:
Kim Matheson

The Department of Psychology offers programs of study and research on a full-time and part-time basis, leading to the degrees of Master of Arts and Doctor of Philosophy. Financial support is available, but is limited to full-time students.

There is a very close link in the Department of Psychology between graduate studies and research. Research in the Department is distributed across the life sciences areas of bio-psychology, animal learning, perception, and cognition, and across the social sciences areas of social and developmental psychology. Its research and graduate program in biopsychology is one of the strongest in Canada, with current research focusing on problems of the neurochemistry of stress and learning; developmental psychopharmacology; experimental models of epilepsy; neuroanatomy; brain lateralization; neural mechanisms of audition; drug dependence; and the effects in animals and humans of prenatal alcohol and drug exposure on postnatal behaviour. The Department has related human neuropsychological research activities dealing with alterations to visual and auditory psychophysical functions associated with neuropathological conditions; determinants, correlates, and treatment of hyperactivity in children; and the relation of behavioural, psychological, and electrophysiological variables to sleep and dreaming states. Within the social sciences realm, a unique laboratory has been developed for the study of hypnosis, approached experimentally from social psychological, perceptual, and cognitive perspectives provided, in part, by other on-going research programs in the Department. In recent years, there has been a growth of activity in aspects of applied psychology, including evaluation research; corrections; education; impact of computer and telecommunications technology; behavioural medicine; and psychological assessment. This has fostered close collaborative contacts between the Department and public service and applied setting in Ottawa, such as the Children's Hospital of Eastern Ontario, the Royal Ottawa Hospital, the National Research Council, Department of Communications (Canada), Ontario Ministry of Correctional Services, and the Ottawa Board of Education. Practica and internships are available in many of these settings to students at the doctoral level.

Because of the breadth of interests in the Department, there is an emphasis in graduate courses on methodological and conceptual issues that are applicable across research specializations. Consequently, most substantive courses, regardless of title, are relevant to most students' programs. Students typically work very closely with their advisers who, through informal tutorials and directed studies and independent research courses, provide much of the opportunity for specialized study. Applicants are strongly encouraged to write directly to faculty members for more specific details on research interests and programs currently underway.

As part of its general experimental program, the Department provides the opportunity to pursue a concentration at the doctoral level in behavioural neuroscience (a collaborative endeavour with the University of Ottawa), human neuropsychology, or human information systems. Applicants should consult with the supervisor of graduate studies for information on structuring a doctoral program of studies within a concentration.

Through a quantitative methods requirement, completion of a demanding empirical thesis presented and defended orally, participation in small seminars, and a close relationship with faculty advisers and students, the M.A. program provides the opportunity for a refinement of critical, logical, and analytical skills; skills of written and oral expression; understanding of the strengths and limitations of the scientific method as a means of problem solving, demonstrated through psychology but applicable to issues in society at large; an understanding of quantification and scaling, the use of statistical methods and inference, and the use of evidence to support argument. For some students this is a satisfactory and satisfying end in itself. For others, it provides a solid preparation for the doctoral program in which original independent study and research is stressed. The Department does not distinguish between an applied and an experimental program; instead, the basic orientation is experimental and theoretical, but with opportunities, where appropriate, to provide complementary experience necessary to work successfully as a psychologist in applied research/service settings.

Augmenting the well-equipped laboratories expected in an active research environment, the Department of Psychology receives excellent technical support from the Carleton University Science Technology Centre, where design and manufacture of special-purpose apparatus is carried out. In addition, the workshops provide technical support for the more than twenty-five computer systems currently in use in laboratories throughout the Department.

Graduate students have access to the Honeywell Level 66 computer system, supported by the Computing Services division of the University.

These systems support a variety of computer languages, including FORTRAN, APL, PASCAL, and BASIC, several microcomputer emulatory programs, a variety of statistical and mathematical packages, such as the BMDP and SPSS systems, and many other programs.

In fulfilling degree credit requirements, all graduate students are required to demonstrate competence in statistical and quantitative methods through successful completion of Psychology 49.540 (with a grade of B– or better) or a qualifying examination. This is ordinarily scheduled during the first part of September, just prior to the registration period, and it encompasses the material covered in Psychology 49.540. In the event of successful completion of the examination, another course is substituted for Psychology 49.540. In the case of M.A. students, the Department may recommend that a grade of C+ in Psychology 49.540 be accepted for credit (see General Regulations, page 24) only after successful completion of the qualifying examination. This option is limited to those who pass the examination within two successive offerings of it, and who maintain continuous registration as graduate students between the first registration in Psychology 49.540 and the taking of the examination.

In addition to fulfilling the remaining credit requirements as described in subsequent sections, all graduate students in psychology are expected to conduct research of interest to them during each year of graduate study. This requirement may be satisfied by independent research, serving as a research assistant, or by doing pilot or thesis research.

Each year, the candidate's adviser submits a written critique of research progress, and this becomes part of the candidate's permanent record. Qualifying-year students are evaluated at the end of the first twelve months.

Depending on his/her field of concentration, a candidate may be required to demonstrate an ability to read with understanding relevant technical material in a foreign language and/or to give satisfactory evidence of competence in such areas as computer techniques, electronic instrumentation, psychometrics, sampling procedures, or surgical techniques.

The Department may recommend that a graduate student be asked to withdraw from the program at any time if his or her progress in course work, research, or comprehensive examinations proves unsatisfactory.

Within the Department exist subgroups of faculty members with common interests and subgroups of courses associated with particular areas of psychology. Below are listed three formally identified fields of concentration with the work which would be expected from any student who decided to pursue interests in one of these fields.

Concentration in Neuropsychology
Concentration in the area of neuropsychology occurs at the Ph.D. level. It is designed to provide students with background and skills relating to the diagnosis and evaluation of psychological disorders that arise from neurological problems and associated brain dysfunction syndromes. Students interested in this area are encouraged to take all four Ph.D. seminars; 49.661, 49.662, 49.663 and 49.664. Also, it is expected that students in this field generate theses in neuropsychology.

Concentration in Cognitive Psychology
The concentration in cognition is intended to provide the graduate student with an advanced knowledge of methodological and theoretical issues in the domain of cognitive psychology. Research interests of regular and adjunct faculty in cognition include perception and psycho-physics, attention, pattern recognition, reading and language processing, cognitive development, learning and memory, problem solving, neuropsychology, and human-computer interactions. Students interested in this area are encouraged to take courses such as 49.570, 49.573, 49.574 and 49.670 and generate theses in the area of cognition.

Concentration in Basic and Applied Social Psychology
The concentration in social psychology is designed to provide students with a fundamental knowledge in the traditional fields of social psychology such as social psychological research methods, attitudes and personality, as well as the application of social psychology to current social issues such as family violence, health promotion, assessment and program evaluation, crime and delinquency, computers, the psychology of women, and sports. Faculty interests span a broad spectrum of perspectives in social, personality, community and applied social psychology. Current research in the Department includes historical and critical social psychology, laboratory

investigations of social processes in decision making, attitudes, and hypnosis, through the applied studies in areas such as family violence, women and the work force, the psychology of women, delinquency, criminal justice and corrections, health promotion, and performance enhancement.

Students interested in this area are encouraged to take courses such as 49.510, 49.511, 49.519 and 49.546 as well as the production of theses in this area.

Qualifying-Year Program

Occasionally, candidates with exceptional promise who offer less than honours B.A. status may be admitted to a qualifying-year program, approved by the graduate studies committee, and designed to prepare them for master's study. A minimum grade of B– must be obtained in each qualifying-year course, and candidates may be required to complete satisfactorily the equivalent of an honours B.A. thesis.

Master of Arts

Admission Requirements
The normal requirement for admission into the master's program is an Ontario honours B.A. (or its equivalent) with high honours standing and with credit in the following areas: statistics and design of experiments; experimental psychology; learning or motivation; physiology and/or comparative psychology; and history and/or systems.

Candidates with particular course deficiencies may be required to register in additional courses at Carleton.

The deadline for submitting applications for graduate study in psychology are as follows: February 1 for students requesting financial assistance; July 1 for students not requesting financial assistance but who are seeking admission in September; and November 1 for students who are seeking admission in January.

Program Requirements
The master's program usually consists of three full courses (or the equivalent), of which at least two must be at the graduate level (numbered 500 or higher), and a thesis (equivalent to two full courses) which must be defended at an oral examination. Psychology 49.540, or the successful completion of the opting-out examination in quantitative methods, is required of all graduate students. Course credit will not be given for successful completion of the opting-out examination.

Master of Science

In conjunction with the Ottawa-Carleton Specialization in Neuroscience, the Department of Psychology offers the M.Sc. degree. The candidate must fulfil the normal program requirements listed above together with the requirements of the specialization (see page 275).

Ottawa-Carleton Collaborative Program in Chemical and Environmental Toxicology
The Department of Psychology at Carleton University and the Departments of Chemistry and Biology at Carleton University and the University of Ottawa, provide a collaborative program in chemical and environmental toxicology at the M.Sc. level. For further details, see page 173.

Academic Standing
A grade of B– or better is normally required in each of the courses counted for credit towards the M.A. degree. The Department is prepared on occasion to recommend to the Dean of the Faculty of Graduate Studies and Research that a candidate be allowed a grade of C+ in one full course or each of two half courses. In the case of Psychology 49.540, such a recommendation will be based on successful completion of the qualifying examination. This option is limited to those who pass the examination within two successive offerings of it, and who maintain continuous registration as graduate students between the first registration in Psychology 49.540 and the taking of the examination.

Doctor of Philosophy

Admission Requirements
The requirements for admission to the Ph.D. program are outlined in the general section of this calendar. Scores on the Graduate Record Examination are also optional.

The Ph.D. program in psychology normally will be undertaken on a full-time basis; however, in cases of exceptional merit, the Department will accept a few candidates for the degree on a part-time basis. A Ph.D. candidate who enters the part-time program will normally be required to be registered as a full-time student for a minimum of three terms, at least two of which are consecutive. The time limit for completion of Ph.D. degree requirements for those who enter the program on a part-time basis will be the same as for those who enter on a full-time basis and subsequently register for part-time study: that is, eight calendar years. (See Time Limits, page 27).

Applicants should note that of the B.A., M.A., and Ph.D. degrees in Psychology, only two may ordinarily be taken at Carleton University.

Program Requirements
The minimum program requirements for the Ph.D. degree in Psychology are as follows:

* Ten full-course credits, with a minimum grade of B– or better in each course
* Psychology 49.540 (one full credit) or the opting-out examination; and one of Psychology 49.541, 49.542, 49.543 or 49.546 or other as approved by the graduate committee are required of all Ph.D. graduate students. In the case of success in the opting-out examination in 49.540, another full credit is substituted
* A thesis equivalent to five of the required ten full-course credits and which must be defended at an oral examination

All Ph.D. candidates are required to submit a thesis prospectus. The prospectus examination will normally be successfully completed within seven calendar terms of the student's initial registration for full-time students and ten terms for part-time Ph.D. students.

Comprehensive Examination
All Ph.D. candidates in psychology are required to pass a written and an oral examination on a topic distinct from the topic of the thesis. The topic of the comprehensive examination shall be approved by the Graduate Studies Committee of the Department of Psychology. There are two optional forms for the written and the oral examination: either a major essay or a research grant proposal. The submission of the written portion of the examination will be followed within one to three weeks by a comprehensive oral examination, which is not restricted to issues raised by the written portion.

Ordinarily the comprehensive examination must be completed successfully before the Ph.D. prospectus meeting is scheduled. The oral defence should normally occur within four calendar terms of the student's initial registration for full-time students in the Ph.D. program or six terms of the students's initial registration in the part-time Ph.D. program.

Graduate Courses*

The following courses are offered in the graduate program but not all are offered every year. Students should consult the university and departmental timetables for a list of courses offered in 1994-95 and their scheduling.

* Psychology 49.510F1
Research Methods in Social Psychology
This course focuses on essential methodological issues in social psychology. These include experimental, quasi-experimental, correlational, survey and field research methods, as well as factors affecting the validity of findings and ethics.

* Psychology 49.511W1
Seminar in Social Psychology
This seminar deals with classic and current theoretical issues and research findings in the areas of social psychology, personality, community, social-developmental and applied social psychology.

* Psychology 49.512F1, W1
Group Processes
The interface between the person and the group has been alleged to be the uniquely defining feature of social psychology. This course examines the evidence for this assertion historically, and across cultures, in an attempt to place current publications in group processes in broader temporal and cultural contexts than research reports normally permit.

* Psychology 49.513F1, W1
Attitudes
This seminar will survey classic and contemporary theories and research examining the nature of attitudes, the attitude-behaviour relation, and factors affecting attitudes.

* Psychology 49.514F1, W1
Psychology of Women
This seminar will consider and evaluate research concerning the psychology of women, including research methods, gender roles and gender differences.

* Psychology 49.515F1
Fundamentals of Computing for Psychologists
A survey of computer and communication hardware and software. The purpose of the course is to make psychologists aware of the concepts and terminology used by engineers and programers in planning computer applications; it is not designed to train students to be programers or to build equipment. The course will have a weekly laboratory.
Prerequisite: One course in computer programing.

* Psychology 49.516F1
Applications of Computers to Thinking, Problem Solving, and Decision Making
A survey of literature in such fields as artificial

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intelligence, database management, computer-aided instruction, simulation and forecasting, and computer-mediated communication. Psychological principles in the design, use, and evaluation of these cognitive aids will be stressed.
Prerequisite: Psychology 49.515.

• Psychology 49.517F1, W1
Psychology of Family Violence
This seminar takes an eclectic approach to the study of child abuse, wife-assault, and other forms of family violence. In an effort to understand the psychological processes associated with family violence, theoretical and empirical work from social, developmental, and community psychology will be considered. In addition, the extent to which early experience of abuse affects the development and functioning of neuroanatomical structures will be examined.

• Psychology 49.518F1
Social Psychological Issues in Human Assessment
A detailed critique of orthodox assessment methodologies and exposure to recent developments in the appraisal of human competencies, personality, and social interaction.

• Psychology 49.519F1, W1.
Historical and Social Foundations of Social Psychology
This course surveys the development of social psychology from the 1850s to the present in both Europe and North America. Emphasis is placed on the development of social psychology as an experimental science within psychology. Part of the course will examine current trends in the sociology of knowledge and the social studies as they apply to social psychology.

• Psychology 49.520T2 (PSY6201)
Basics of Neuroscience
A comprehensive neuroscience course from the membrane and the cellular levels through to the behavioural aspects of invertebrates and vertebrates. Lectures and tutorials will cover such aspects of neuroscience as neuroanatomy, neuro-physiology, behavioural neuroscience and neuro-pharmacology. (Also offered as Biology 61.534)

• Psychology 49.521F1, W1
Environmental Psychology and Social Ecology
Using a combination of lectures and seminar presentations, this course considers theory, methods, research and applications in the fields of environmental psychology and social ecology. Topics include spatial behaviour, cognitive mapping, territoriality, behaviour setting analysis, personal space, crowding, environmental dispositions, psychological assessment of environments,

social ecological models of stress and health promotion, and psychological aspects of architectural and environmental design. The course is designed for psychology students but may be of interest to advanced students in the fields of geography, sociology and architecture. For those who are not graduate students in psychology, permission to register in the course is required from the instructor.

• Psychology 49.522F1,W1
Psychology and Criminal Justice
A critical review of the contributions of psychological concepts, technology and research methodology to the analysis of selected issues in law and criminal justice. Topics may include victim studies, forensic psychology, police studies, expert testimony, eyewitness and bystander behaviour, judicial decision making, the psychologist as advocate and apologist, and the social psychological status and functioning of criminal justice and correctional practitioners. The ethics of psychological intervention in criminal justice are reviewed, along with critiques of criminal justice policy.

• Psychology 49.523F1,W1
Psychology in the Human Services
This seminar will review and evaluate non-clinical roles for psychologists in the human services. The major roles reviewed include those of consultant, researcher, evaluator, trainer, and policy analyst. Illustrative efforts in a variety of settings will be reviewed with particular attention to conditions which facilitate and inhibit organizational change and the adoption, implementation and maintenance of innovative programing.

• Psychology 49.524F1, W1
Principles and Methods in Behavioural Toxicology
A half-credit course (one term) examining the basic concepts of behavioural toxicology starting with a general discussion of behaviour testing methodology and then focusing on procedures used in screening chemicals for behavioural effects, and more advanced tests. Controversial examples from current research are used to illustrate the practical problems of assessing both animal and human behavioural toxicity.

• Psychology 49.525F1
Principles of Toxicology
The basic theorems of toxicology with examples of current research problems. The concepts of exposure, hazard and risk assessment will be defined and illustrated with experimental material from some of the more dynamic areas of modern research. (Also offered as Biology 61.642 and Chemistry 65.578)

• Psychology 49.526W1
Seminar in Toxicology
A two-term course in seminar format, highlighting current topics in toxicology. The course will feature student, faculty and invited seminar speaker.
(Also offered as Biology 61.645 and Chemistry 65.585)

• Psychology 49.530W1
Perceptual Processes
Theoretical and empirical issues of the area of perception. The topics may include: psycho-physics, constancies, depth perception, pattern recognition, iconic memory, attention, hemispheric specialization.

• Psychology 49.531F1,W1
Psychophysics
A study of classic and contemporary psycho-physical methods. Applications to cognition will be included.

• Psychology 49.540T2
Quantitative Psychology I: Univariate Techniques
Applications of the general linear model including analysis of variance and multiple regression: prediction and estimation. Extensive use is made of computer statistical packages.

• Psychology 49.541F1
Quantitative Psychology II: Multivariate Techniques
Applications of multivariate statistical techniques with psychological data including multivariate analysis of variance, canonical correlation, discriminant function analysis, and factor analysis. Extensive use is made of computer statistical packages.
Prerequisite: Psychology 49.540.

• Psychology 49.542W1, S1
Descriptive and Nonparametric Statistics
An overview of methods for assisting in the detection and explanation of patterns in data that do not satisfy parametric test assumptions. Topics may include exploratory data analysis, information analysis, prediction analysis, ordinal pattern analysis, and conceptual issues in statistics.
Prerequisite: Psychology 49.540.

• Psychology 49.543W1, S1
Measurement and Scaling: Theory Methods and Applications
An examination of the various fundamental measurement and derived measurement and scaling systems encountered in the social and behavioural sciences. Theoretical foundations and applications of extensive, conjoint, difference, utility and subjective probability, similarity and preference systems are studied. Multidimensional scaling of similarities and preference data is emphasized as is use of the

available computer based routines.
Prerequisite: Psychology 49.540.

• Psychology 49.546W1, S1
Quasi-experimental Design and Evaluation Research
Coverage of methodological and statistical problems occurring in the field settings and program evaluations.
Prerequisites: Psychology 49.540, and one of 49.541, 49.542, 49.543.

• Psychology 49.547F1
Tests and Measurements I – Intellectual/Cognitive
This course is designed to assist students learn basic cognitive/intellectual assessment procedures. Students will be required to administer and interpret a variety of tests such as the WAIS-R, Weschler Memory Scale, Rey Auditory Verbal Learning Test and Buschke's Cued Recall Test.
Prerequisite: Undergraduate course in testing or psychometrics.

• Psychology 49.548W1
Tests and Measurements II – Personality
This course is designed to assist students learn basic projective and non-projective personality tests. Students will be required to administer and interpret a variety of personality tests such as MMPI, Rorschach, 16-PF, and STAI. Applied experience will be stressed.
Prerequisite: Psychology 49.547.

• Psychology 49.551F1
Developmental Psychology I
A detailed examination of selected issues in developmental psychology.

• Psychology 49.552W1
Developmental Psychology II
A continuation of 49.551.

• Psychology 49.561W1
Contemporary Research in Personality
Current controversial issues in personality research, and selected theoretical and research studies in personality.

• Psychology 49.570F1
Advanced Topics in Cognition I
An in-depth study of specific topic in the area of basic cognitive processes. Topics will vary from year to year and may include judgemental processes, object identification, selective attention and spatial cognition.

• Psychology 49.573W1
Cognition I
A survey of issues and research methodologies in basic cognitive processes. Topics may include detection and processing of sensory signals, pattern

recognition, attention, mental imagery and automaticity.

• Psychology 49.574W1
Cognition II
A survey of issues and research methodologies in higher-level cognitive processes. Topics may include memory, representation of knowledge, decision processes, and the procedural/declarative controversy. The course may be focused on a particular area (e.g. reading, transfer in problem solving).

• Psychology 49.575F1
Behaviour Modification I
The basic principles of learning as they apply to the modification of behaviour, with emphasis on application, ethics, research, and methodology.

• Psychology 49.576W1
Behaviour Modification II
Special problems, topics, and projects related to behaviour modification.
Prerequisite: Psychology 49.575.

• Psychology 49.580F1, W1, S1
Special Topics in Psychology
The topics of this course will vary from year to year, and will be announced in advance of the registration period.

• Psychology 49.590F1, W1, S1
Directed Studies
An investigation in depth of selected problems in psychology by means of directed library research. Registration is restricted, permission to register being granted only by the graduate committee. A final report must be filed in the departmental office prior to submission of course grade.

• Psychology 49.591F1, W1, S1
Independent Research
Permission to register and approval of research plan must be obtained from the graduate committee. A final research report must be filed in the departmental office prior to submission of course grade. The course may be repeated for credit.

• Psychology 49.593F1, W1
Practicum in Psychology
The practicum offers graduate students experience in a range of applied psychology setting (for example, hospitals, schools, and correctional centres). Students participate in training sessions and work experience, facilitating the integration of academic and practical aspects of psychology. It is designed to supplement the course material offered at Carleton and should not be viewed as constituting a clinical internship. This course is only available to master's students and cannot be repeated for credit. Students will receive a grade of satisfactory or unsatisfactory.

Details of the current practicum placements are available from the Department.

• Psychology 49.599F4, W4, S4
M.A. Thesis

• Psychology 49.600F1
Systems of Psychology
Historical research methods on the study of psychological movements and problems of the late nineteenth and early twentieth centuries; may be repeated for credit. (Open with permission to advanced undergraduates.)

• Psychology 49.601W1
Problems in the History of Psychology
A study of one or more selected topics in this history of man's attempt to understand his own nature; may be repeated for credit. (Open with permission to advanced undergraduates.)

• Psychology 49.603F1
Observation, Description, and Explanation in Psychology
Problems of communication, concept formation, and exploration in the biosocial sciences are discussed. The interplay of facts, methods, models, theories, and the human values which these serve are also explored.

• Psychology 49.612F1
Experimental Hypnosis
Selected issues in the study of experimental hypnosis will be critically reviewed. The problem of hypnotic susceptibility and its correlates will be given particular attention. Relationships among hypnotic phenomena, meditation, and behaviour therapy will be evaluated.

• Psychology 49.613
Sleeping and Dreaming
Modern research in sleeping and dreaming will be examined from different perspectives. Major emphasis will be placed on recent theory, method and measurement in sleep and dream research from the points of view of developmental neuro-cognition, psychophysiology and chronobiology. Disorders of sleeping behaviour and experience in children and adults will be considered as will cross-species comparative approaches. The course will focus on the functions of sleeping and dreaming and examine the effects of these behaviours on waking behaviour and experience.

• Psychology 49.615F1
Psychological Aspects of Computer Use
An investigation of human factors related to the effective design of computer hardware and software. Topics may include the design and evaluation of information search procedures, graphic displays,

and operation manuals on the assessment of useability. A research project will be required.

• Psychology 49.616W1
Social Aspects of Computer Use
An investigation of the social psychological and political factors affecting the adoption and use of computers. Topics may include the design and evaluation of training programs, the assessment of attitudes towards computers, threats to privacy and jobs, and computer crime. Emphasis will be placed upon the organizational and interpersonal changes resulting from the introduction of computers into work settings. A research project will be required.

• Psychology 49.620T2
Advanced Seminar in Neuroscience
An advanced seminar course integrating various aspects of neuroscience.
Prerequisite: Psychology 49.520 or 49.623
(Also offered as Biology 61.633)

• Psychology 49.623T2 (ANA5470,PHS5470)
Neuroanatomy and Neurophysiology
An integrated course on the central nervous system given by the Departments of Anatomy and Physiology of the University of Ottawa and their invited lecturers.

• Psychology 49.624F1 (ANA7400 FallTerm)
Neuroscience Techniques I
Completion of a research project carried out under the supervision of a neuroscience faculty member from a Department other than the student's enrolling Department.
(Also offered as Biology 61.623)

• Psychology 49.625W1 (ANA7400 Winter Term)
Neuroscience Techniques II
Completion of a research project carried out under the supervision of a neuroscience faculty member from a Department other than the student's enrolling Department. The supervisor must be different from that of 49.624.
(Also offered as Biology 61.624)

• Psychology 49.626F1
Comparative Psychology
Varied and acquired adaptive mechanisms and their phylogenesis. Topics will include attachment behaviour, social organization, learning abilities, communication, and motivation.

• Psychology 49.650F1
Research Seminar in Developmental Psychology I

• Psychology 49.651W1
Research Seminar in Developmental Psychology II

• Psychology 49.661F1
Seminar in Human Neuropsychology I
A broad and intensive consideration of selected topics in human neuropsychology, integrating findings from psychology with related medical literature.

• Psychology 49.662W1
Neuropsychological Assessment
Review of the rationale and practice of diagnosis and treatment based on neuropsychological test results. The reliability and validity of test batteries such as the Halstead-Reitan and the Luria-Nebraska are studied. A variety of methods of test interpretation are utilized in clinical analysis of patient protocols, including degenerative diseases, psychiatric disorders, seizures, head injury, and brain tumors.
Prerequisite: Psychology 49.661.

• Psychology 49.663F1
Seminar in Human Neuropsychology II
(Same description as 49.661)

• Psychology 49.664W1
Theories of Brain Dysfunction in Psychopathology
A review of neuropsychological theoretical explanations and empirical findings regarding brain functioning in a variety of organic and psychiatric disorders, such as autism, schizophrenia, minimal brain dysfunction, anorexia nervosa, aphasia, and memory disorders. These disorders are examined from neurological, psychological, biochemical, and neuropsychological points of view.
Prerequisite: Psychology 49.661.

• Psychology 49.665F1
Comparative Neuropsychology
An examination, from a comparative perspective, of research and logic associated with the study of brain-behaviour relations. The objective of the course is to provide a background and orientation for evaluating infra-human research of brain-behaviour relations, and for relating such research to problems of human neuropsychology.

• Psychology 49.666W1
Human Communication Disorders
The course provides an overview of normal and abnormal functions of the auditory systems, particularly as it relates to the perception of human speech sounds. Diagnosis of clinical syndromes will be covered.

• Psychology 49.667W1
Developmental Psychopharmacology
The synthesis and metabolism of various neurotransmitters are detailed with respect to their role in behaviour modulation. The ontogeny of these systems is considered, as are behavioural changes which

occur as a consequence of aberrant neurochemical activity. (Open with permission to advanced undergraduates)

• Psychology 49.670F1, W1
Advanced Topics in Cognition II
An in-depth study of a specific topic in higher-level cognitive processes. Topics will vary from year to year and may include mathematical knowledge and processes, problem solving, or models of reading.

• Psychology 49.680F1, W1
Special Topics in Psychology
(Same description as 49.580)

• Psychology 49.690F1, W1, S1
Directed Studies
(Same description as 49.580)

• Psychology 49.691F1, W1, S1
Independent Research
(Same description as 49.591)

• Psychology 49.693F1, 49.694W1
Practicum in Psychology
The practicum offers graduate students experience in a range of applied psychology settings (for example, hospitals, schools, and correctional centres). Students participate in training sessions and work experience, facilitating the integration of academic and practical aspects of psychology. They are designed to supplement the course material offered at Carleton and should not be viewed as constituting a clinical internship. These courses are only available to Ph.D. students and cannot be repeated for credit. Students will receive a grade of satisfactory or unsatisfactory. Details of the current practicum placements are available from the Department.

• Psychology 49.699F, W, S
Ph.D. Thesis

Through interuniversity cooperation in graduate instruction, full-time graduate students registered in the Department of Psychology may enrol in one course at the University of Ottawa.

The Ottawa-Carleton Specialization in Neuroscience

Life Sciences Research
Building 325
Telephone: 788-4020
Fax: 788-4052

The Specialization

Coordinator of the Specialization:
J.B. Kelly

Neuroscience is the study of the nervous system and its function. This emerging field cuts across many disciplines and incorporates such areas as anatomy, neurobiology, pharmacology, physiology and psychology. While individual researchers usually specialize in a particular area, neuroscientists today must also be able to appreciate significant research in the other fields and therefore require an understanding of the basics of the other disciplines.

Training in the neurosciences extends past the boundaries of traditional departments. In response to the challenge of providing a comprehensive education for future neuroscientists, the University of Ottawa and Carleton University now offer a multi-disciplinary specialization in neuroscience.

The specialization is intended to augment the research and training which the student receives through one of the "primary" departments which are participating in the neuroscience specialization. The departments are:

- Department of Anatomy, University of Ottawa
- Department of Biology, Carleton University
- Department of Biology, University of Ottawa
- Department of Physiology, University of Ottawa
- Department of Psychology, Carleton University
- School of Psychology, University of Ottawa

Five additional departments from the University of Ottawa Medical School are also affiliated.

- Department of Medicine (Division of Neurology)
- Department of Neuropathology
- Department of Pharmacology
- Department Psychiatry
- Department of Surgery (Division of Neurosurgery)

The specialization is coordinated by a committee consisting of representatives from each of the participating departments.

Application should be made to the primary department which is most appropriate to the student's research interest. Once accepted by the department, students must be sponsored into the specialization by a member of the neuroscience faculty.

Application forms and further information can be obtained by writing directly to any of the "primary" departments.

Members of the Neuroscience Specialization

Hymie Anisman, *Stress, Coping, Depression, Catecholamines*

Catherine Bielajew, *Brain Stimulation Reward, Feeding Mechanisms and Thermal Regulation*

Roger Broughton, *Biological Rhythms, Sleep Disorder*

Joseph de Koninck, *Sleep Cycles, Biorhythms, Dreams*

Jack de la Torre, *Brain and Spinal Trauma, Central and Peripheral Regeneration, Stroke*

George Fouriezos, *Brain Stimulation Reward*

P.A. Fried, *Alcohol, Marihuana, Smoking and Pregnancy*

James Fryer, *Neurohypophysical Hormones, Neuropeptides, Teleost Endocrine Function, Neuropetide Gene Expression*

D.R. Gardner, *Patch Clamping, Pesticides, Invertebrate CNS*

Walter Hendelman, *Tissue Culture, Locus Coeruleus, Growth Factors*

Pavel Hrdina, *Antidepressants, Imipramine Binding, Central Neurotransmitters*

J.B. Kelly, *Auditory System Structure and Function*

R.M. Knights, *Head Injury, Cognition Behaviour*

Symon Lemaire, *Neuropeptides, Receptor Modulation, Catecholamines, Phencyclidine Receptors*

Michael McBurney, *Neuronal Cell Differentiation, Molecular Biology, Gene Expression, Teratocarcinomas*

Kenneth Marshall, *Neurotransmitters, Neural Development, Neuronal Regeneration*

Irene Mazurkiewicz-Kwilecki, *Brain Histamine, Aging, Stress, Drug Abuse*

D.C. McIntyre, *Epilepsy, Kindling, Learning, Memory*

Zulfiquar Merali, *Peptides, Catecholamines, Behaviour*

Theris Miliaressis, *Psychobiology, Brain Stimulation Reward, Neuroleptics*

Vital Montpetit, *Pyridoxine Neurotoxicity, Alzheimer's Disease, Leukoencephalopathy*

Catherine Morris, *Single Channel Studies, Acetylcholine Activation*

B.A. Pappas, *Locus Coeruleus, Behavioural Teratology*

David Parry, *Muscular Dystrophy, Neurotrophic Interactions, Myosin Isoenzymes, Muscle Regeneration, Muscle Development*

David Peters, *Brain Development, Stress, Neuro-pharmacology*
Terence Picton, *Evoked Potentials, Information Processing, Sensory Pathways*
R.T. Pivik, *Sleep, Neurophysiology, Psycho-physiology, Biological Psychiatry*
D.C.S. Roberts, *Drug Abuse*
William Staines, *Neuroanatomical Tracers, Neuro-transmitters, Neuronal Tissue Culture and Trans-plantation*
B.W.Tansley, *Spatial Vision, Retinitis Pigmentosa, Neurotoxicity, Visual, Auditory Systems*
T.N.Tombaugh, *Drug Abuse, Neuroleptics*
Jose-Maria Trifaro, *Neurotransmitter Synthesis, Storage and Secretion*
R.M. Zacharko, *Intracranial Self-stimulation, Stress, Depression, Dopamine, Anhedonia*

Master's Program

Admission Requirements
The requirements for admission to the master's neuroscience specialization are as follows:
- Prior admission to the master's program of the primary department which participates in the specialization
- A letter of recommendation from a participating faculty member of the neuroscience specialization, which both recommends admission and indicates the willingness of the faculty member to supervise the candidate's research program

Students with less than a high honours average in their undergraduate and graduate courses will not normally be recommended for admission.

Program Requirements
In addition to fulfilling the requirements for the master's program of the department in which they are enrolled, the specialization requires that the students successfully complete one of the two courses: Basics of Neuroscience or Neuroanatomy and Neurophysiology. The thesis research must concern a neuroscience topic and must be supervised by a member of the neuroscience faculty. The student is expected to join the Ottawa Neurosciences Society and attend its scientific meetings.

Doctor of Philosophy

Admission Requirements
Admission requirements to the Ph.D. neuroscience specialization are as follows:
- Prior admission to the Ph.D. program of the primary department which participates in the specialization

- A letter of recommendation from a participating faculty member of the neuroscience specialization, which both recommends admission and which indicates the willingness of the faculty member to supervise the candidate's research program
- Two additional letters of recommendation from University faculty who are familiar with the candidate's academic and research career
- Students with less than a high honours standing in their undergraduate and graduate courses will not normally be recommended for admission

Selection of master's and doctoral students is carried out by the neuroscience specialization coordinating committee which will select and rank the admissible candidates. Admission is determined by priority of ranking and the number of admissions depends upon the available positions in the specialization.

Program Requirements
Students must fulfil the Ph.D. program requirements of the department in which they are enrolled. The requirements for the specialization also include the following, some of which may satisfy the Ph.D. requirements of the participating departments:
- The student is expected to join the Ottawa Neurosciences Society and attend its scientific meetings
- Successful completion of the following neuroscience courses: Advanced Seminar in Neuroscience (49.621), Neuroscience Techniques I and II (61.623F1 and 61.624W1) and one of Basics of Neuroscience (49.520) *or* Neuroanatomy and Neurophysiology (49.623)
- A thesis in the area of neuroscience, which must be defended at an oral examination

Graduate Courses*

A variety of neuroscience courses are available through the primary departments. These currently include behavioural neuroscience, neuroendocrinology, clinical neuropsychology, neurophysiology, synaptic transmission and behavioural medicine. Course offerings vary slightly from year to year and a complete listing can be obtained from the specialization coordinator.

The following are the five core courses of the curriculum.

- Psychology 49.520T2 (PSY6201)
Basics of Neuroscience
A comprehensive neuroscience course from the membrane and the cellular levels through to the

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* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

behavioural aspects of invertebrates and vertebrates. Lectures and tutorials will cover such aspects of neuroscience as neuroanatomy, neurophysiology, behavioural neuroscience and neuropharmacology. (Also offered as Biology 61.534)

● Biology 61.623F1 (ANA7400 Fall Term)
Neuroscience Techniques I
Completion of a research project carried out under the supervision of a neuroscience faculty member from a department other than the student's enrolling department.
(Also offered as Psychology 49.624)

● Biology 61.624W1 (ANA7400 Winter Term)
Neuroscience Techniques II
Completion of a research project carried out under the supervision of a neuroscience faculty member from a department other than the student's enrolling department. The supervisor must be different from that of Biology 61.623.
(Also offered as Psychology 49.625)

● Psychology 49.620T2
Advanced Seminar in Neuroscience
An advanced seminar course integrating various aspects of neuroscience.
Prerequisite: Psychology 49.520 or 49.623
(Also offered as Biology 61.623)

● Psychology 49.623T2 (ANA5470, PHS 5470)
Neuroanatomy and Neurophysiology
An integrated course on the central nervous system given by the departments of Anatomy and Physiology of the University of Ottawa and their invited lecturers.

School of Public Administration

Dunton Tower 1021
Telephone: 788-2547
Fax: 788-2551

The School

Director of the School:
K.A.H. Graham
Associate Director:
C.M. Carmichael
Coordinator, Specialization in Development Administration:
M.A. Bienefeld
Coordinator, Ph.D. Program in Public Policy:
S.L.Winer

The School of Public Administration was established in 1953 through the assistance of a generous grant from the Atkinson Charitable Foundation.

The School offers graduate programs of study and research in the fields of public administration and public policy leading to the graduate Diploma in Public Administration, the Master of Arts degree in Public Administration, and the Ph.D. in Public Policy. Prospective applicants are urged to evaluate these opportunities carefully in order that they may select the one most suitable to their interests, background, and academic qualifications.

Students are encouraged to acquire French language skills. Undergraduate French language courses may be taken as extra to degree, and many other options are available in the National Capital Region. Students may consult the School.

Diploma in Public Administration (D.P.A.)
This diploma program, which consists of five full-credit courses or the equivalent, is more fully described below. It is designed to offer those persons in (or planning to enter) administrative careers an opportunity to begin acquiring some introductory exposure to subject matter related to administrative studies.

Master of Arts
The M.A. program is designed to provide a balanced exposure to both administrative studies and public policy. It is more fully described on the following pages.

Two main areas of specialization are offered:
1) Canadian public administration and policy, and
2) development administration
The development administration specialization is offered with the cooperation of the Norman Paterson School of International Affairs. Only students who intend to complete the M.A. program are admitted to the development administration specialization. However, these students are eligible to receive the D.P.A. upon completion of the required courses. The requirements of the development administration specialization are described in the section dealing with the Master of Arts.

Ph.D.
The School offers a doctoral degree in public policy. This program involves the intensive study of the formation and evolution of public policy in Canada and, from a comparative perspective, in OECD countries generally. A central feature of the course of studies is the integration of political science and economics. Requirements for the Ph.D. program are listed in detail beginning on page 283.

Inquiries and requests for further information should be directed to the School.

Graduate Diploma in Public Administration

The Diploma in Public Administration is designed to offer those persons in (or planning to enter) administrative careers an opportunity to begin acquiring some introductory exposure to subject matter related to administrative studies. The program consists of five full-credit courses and may be taken on a part-time, full-time, or mixed part-time and full-time basis.

The program is based on the recognition that persons with widely varying backgrounds will enter it. Students who successfully complete the D.P.A. program may apply for admission to the M.A. program, at which time they will be considered for admission along with all other applicants. If all of the first-year courses are not taken as part of the D.P.A., they will be required in addition to the final M.A. courses.

Admission Requirements
Admission to the graduate program in public administration is selective. To be considered for admission, an applicant must have a bachelor's degree with at least high honours standing from a recognized university, and must have completed courses in introductory economics (Economics 43.100 or the equivalent) and Canadian government and politics (Political Science 47.200 or the equivalent), with the required standing. All students are

expected to have a working knowledge of the material in these courses.

Applicants are advised to submit applications before May 1 as enrolment in the School is limited.

Program Requirements
The program consists of five full-credit courses, at least four of which must be completed at Carleton. Advanced standing may be granted in one full course (or equivalent) if previous work is judged to be equivalent to courses required in the program. A student who has taken one (or more) of the other required courses prior to admission must substitute another course (or courses) in consultation with the supervisor of graduate studies. In the event that a part-time student is required by his/her employer to move away from Ottawa, he/she may apply to complete one full course or the equivalent at another university, provided that no transfer of credit was granted on admission.

Students in the Canadian stream are required to complete any five full courses from the following program:
- Administration 50.500: Public-Sector Managing and the Canadian Political System
- Administration 50.510: Management Accounting and Administration
- Administration 50.511: Financial Management
- Administration 50.522: Macroeconomics for Management and Policy
- Administration 50.523: Microeconomics for Management and Policy
- Administration 50.525: The Canadian Economy
- Administration 50.530: Organizational Behaviour I
- Administration 50.536: Law of Public Authorities I
- Administration 50.551: Quantitative Methods I
- Administration 50.552: Quantitative Methods II
- Administration 50.567: Political Economy of the State
- Administration 50.568: Policy and Decision Making

Part-time students already admitted to the D.P.A. program under the provisions of previous calendars may adjust their programs to take advantage of the revised program outlined above.

Academic Standing
All candidates are required to obtain a grade of B– or better in each course in the program. A candidate may, with the recommendation of the School and the approval of the Dean of the Faculty of Graduate Studies and Research, be allowed a grade of C+ in one half course.

Master of Arts

The master's program is specifically designed to provide the prospective and mid-career administrator with a balanced exposure to administrative studies and to public policy.

The contemporary manager or administrator is increasingly required to be both a policy adviser and formulator and to have a substantive understanding of the many disciplines and variables associated with the decision-making process in contemporary organizations. University programs can begin to provide some of the foundations that will enable persons to acquire an understanding of the broad financial, legal, economic, political, and social interrelationships that affect decisions in any organization.

The Canadian public administration and policy specialization in the M.A. program is designed to prepare students for managerial, policy, and managerial-support roles in the public services of Canada (federal, provincial, regional, and municipal), and to accelerate and enrich the education and the development of those already performing such roles. Because it is conducted in conjunction with, and draws upon, a program of advanced research in administrative studies and public policy, it is also designed to meet the educational needs of those who wish to undertake graduate-level work in public policy and management, but who may not have a current commitment to public service careers.

A limited number of optional Co-op placements are available to full-time students in the School. This involves the placement of a student in a government department or other organization to work at a junior officer level for at least one term. The Co-op program facilitates the integration of the academic and practical aspects of public administration. It is offered to selected full-time students who meet the eligibility requirements, and is dependent on the number of suitable placements that are available. Co-op placements are not for credit.

The specialization in development administration is offered in conjunction with the Norman Paterson School of International Affairs. This program is designed to address the unique nature and problems of developing countries, giving international students and others with work experience in this field, the knowledge and skills necessary to function successfully in the particular environments of these countries.

Degree Schedules
The degree can be taken in one of three basic modes: full time, part time, or through a mixed part-time and full-time schedule:

• The Full-time Schedule

A full-time student can complete the program in two years (four academic terms), but typically may require a fifth (usually summer) term to complete the requirements, depending upon the amount of advanced standing granted for previous courses.

• The Part-time Schedule

A part-time student normally completes from two to four half courses during the regular academic year, typically in evening courses. Certain courses are also available during the summer term. The duration of a part-time program normally varies from five to eight years.

• Mixed Part-Time and Full-Time Schedule

This schedule enables the student to alternate periods of full-time and part-time study. Typically, students will begin on a part-time basis, but may study on a full-time basis for at least one semester. Such full-time study, which may commence in either the fall, winter or spring term, is especially suitable for practising mid-career administrators as it facilitates a flexible sequence for study and normal work periods.

Admission Requirements

To be considered for admission, an applicant must have a bachelor's degree (or equivalent) with at least high honours (upper second class) standing from a recognized university, and must already have completed courses in introductory economics (Economics 43.100 or equivalent) and Canadian government (Political Science 47.200 or equivalent), with the required standing.

All students are expected to have a working knowledge of the material in these courses.

Applicants to the development administration stream will not be required to complete the Canadian government prerequisite. These applicants must, however, satisfy the economics prerequisite prior to admission. In addition, they are advised that they must provide proof of a capacity to study and communicate in English; have a working knowledge of mathematics at least at the high school matriculation level; and, have completed not less than three years of relevant work experience (exclusive of teaching) on development projects or in the areas of development assistance or development planning. Students deficient in any of these areas will be required to rectify these deficiencies prior to being considered for admission. The School normally requires applicants to write the Graduate Record Examination Aptitude Test.

The development administration stream is considered to be a program of full-time study, exclusively. A limited number of scholarships are available for visa students.

Applicants are advised to submit applications before May 1 (and prior to March 1 for the development administration stream) as enrolment in the School is limited. Students applying to the Canadian stream who wish to be considered for financial assistance and scholarships should have their applications in by March 1.

The School also gives special consideration to mid-career applicants. To qualify for mid-career admission, applicants must have spent several years in one of the public services, or be performing managerial or related functions in a private-sector organization and have demonstrated excellence in their performance in these organizations.

The School's admission policy will, of course, be governed by the availability of graduate student space and the need to admit applicants from a variety of disciplines and backgrounds (for example, social sciences, humanities, law, engineering, or science). Possession of the minimum admission requirements does not, in itself, guarantee acceptance.

Advanced standing may be granted for required courses only if previous work is judged to be equivalent to courses required in the program. Advanced standing and transfer of credit must be determined on an individual basis in consultation with the director, and must also be approved at the time of admission by the Dean of the Faculty of Graduate Studies and Research. In general, a grade of B+ or better is required in equivalent courses to obtain advanced standing.

Program Requirements

The M.A. program comprises twenty half-credit courses (or the equivalent).

Students generally begin their program with required courses; it is possible, however, to take a mixture of optional and required courses throughout both years, provided that the student has the necessary prerequisites for any specific options selected.

Canadian Public Administration and Policy Specialization

Required Courses
• Administration 50.500: Public-Sector Managing and the Canadian Political System
• Administration 50.510: Management Accounting
• Administration 50.511: Financial Management
• Administration 50.522: Macroeconomics for Management and Policy
• Administration 50.523: Microeconomics for Management and Policy
• Administration 50.525: The Canadian Economy
• Administration 50.530: Organizational Behaviour I
• Administration 50.536: Law of Public Authorities I
• Administration 50.551: Quantitative Methods I
• Administration 50.552: Quantitative Methods II

- Administration 50.567: Political Economy of the State
- Administration 50.568: Policy and Decision Making

Unless advanced standing has been granted, full-time students in the fall term of their first year will take: 50.500; 50.567; 50.523 and one other required course.

In the winter term, they will take 50.522; 50.530 and, normally, three other required courses.

Students who have successfully completed the requirements for the Diploma in Public Administration and who are unable to continue their M.A. program may be awarded the diploma, provided that four full courses have been taken at Carleton University.

Optional Courses
- One half course selected from Stream 1 listed below, and
- Two half courses selected from Stream 2 listed below, and
- Five half courses selected from any of the streams listed below, or
- A thesis (equivalent to four half courses) and one half course option
- A research essay (equivalent to two half courses) and three half course options

Development Administration Specialization

Required Courses
- Administration 50.510: Management Accounting
- Administration 50.511: Financial Management*
- Administration 50.523: Microeconomics for Management and Policy
- Administration 50.530: Organizational Behaviour I*
- Administration 50.551: Quantitative Methods I
- Administration 50.552: Quantitative Methods II
- Administration 50.568: Policy and Decision Making*
- International Affairs 46.507: Theories of Development and Underdevelopment
- International Affairs 46.508: Development Planning: Theory and Practice
- International Affairs 46.537: Macroeconomics in a Development Context

Students who are unable to continue in their M.A. program may be awarded the Diploma in Public Administration provided that they successfully complete the diploma requirements and that four full courses have been taken at Carleton University.

Optional Courses
In consultation with the coordinator of the development administration specialization, students must select *either*:
- Ten half courses from Stream 3 listed below, *or*
- A special project in development administration (50.597, equivalent to two half courses) and eight other half-course options from Stream 3

* Special sections of these courses will be offered for students in the development administration specialization.

Stream 1 — Public Policy Analysis

Administration
50.503	Policy and Administration in Intergovernmental Relations
50.502	The Political Economy of Regulation
50.513	Budget Decision Making and Budgeting
50.524	Advanced Microeconomics for Policy Analysis
50.560	Industrial Policy: Theory and Practice I
50.561	Industrial Policy: Theory and Practice II
50.564	Social Policy
50.566	Science and Technology Policies
50.569	Public Choice: Theory and Application
50.570, 571, 572, 573	Policy Seminars
50.574	Urban Policy Analysis
50.575	Advanced Statistical Policy Analysis

Stream 2 — Public Management

Administration
50.514	Public-Sector Accounting and Finance
50.515	Management in the Public Service
50.516	Urban and Local Government Management
50.517	Public Management in Developing Countries
50.518	Marketing for Non-Profit Organizations
50.519	Management of Public Enterprise
50.520	Public-Sector Investment and Pricing
50.528	Management Information Systems I
50.529	Management Information Systems II
50.531	Organizational Behaviour II
50.537	Law of Public Authorities II
50.538	The Management of Provincial Government
50.562	Planning and Evaluation in Government I
50.563	Qualitative Research in Public Organizations
50.581	Human Resources Management
50.583	Problems in Organizational Change and Development
50.584	Industrial Relations and Public-Sector Collective Bargaining
50.585	Public-Sector Collective Bargaining

Stream 3 — Development Administration

Administration
50.502	The Political Economy of Regulation
50.514	Public-Sector Accounting and Finance
50.519	Management of Public Enterprise
50.520	Public-Sector Investment and Pricing
50.528	Management Information Systems I
50.529	Management Information Systems II
50.536	Law of Public Authorities I
50.562	Planning and Evaluation in Government
50.563	Qualitative Research in Public Organizations

50.565	Government-Industry Policy Relations
50.572	Regional Policy
50.574	Urban Policy
50.597	Special Project in Development Administration (1 credit)

International Affairs

46.506	Agriculture and Rural Development
46.512	Canada and International Development
46.538	International Economics: Policy and Theory
46.539	International Financial and Monetary Institutions and Policy
46.545	International Organizations in International Affairs
46.561	Historical Dimensions of Development and Underdevelopment
46.563	Issues in Development in Africa
46.564	Issues in Development in Latin America
46.565	The Ethical Dimension of International Affairs
46.567	Issues in Development in Southeast Asia
46.569	Social Cost-Benefit Analysis and Development Project Evaluation
46.581	Regional Cooperation Among Developing Countries

Economics

43.533	Regulation and Public Enterprise
43.543	Public Choice
43.547	Project Evaluation
43.554	Economic Development: Internal Aspects
43.562	International Monetary Theory and Policy

Political Science

47.545	Public Administration in Developing Countries

School of Business

42.510	Seminar in Management and Administration
42.511	Seminar in Organizational Design

Stream 4 — Recommended options offered by other departments and schools at Carleton University and by the University of Ottawa

(This is not a complete list of all the acceptable options. Students should contact the supervisor of graduate studies or the director for approval if there are other courses they wish to take which are not on this list.)

Economics

43.505	Econometrics
43.511	Canadian Economy I
43.532	Competition Policy
43.533	Regulation and Public Enterprise
43.541	Public Economics: Expenditure
43.542	Public Economics: Taxation
43.547	Project Evaluation
43.555	Economic Development: International Aspects
43.581	Regional Economics
43.582	Urban Economics

International Affairs

46.511	Canada in the International Political Economy
46.512	Canada and International Development
46.513	Canada and International Conflict
46.530	International Enterprise
46.531	International Industries
46.532	Science, Technology, and International Affairs: The Advanced, Industrial Countries
46.533	Science, Technology, and International Affairs: The Third World

Journalism and Communication

28.500	Journalism and Society I
28.560	Journalism and Society II

Law

51.440	The Arbitration Process in Industrial Relations
51.445	Labour Relations in the Public Service
51.450	Canadian Constitutional Law
51.456	Administrative Law I
51.457	Administrative Law II

Political Science

47.501	Canadian Provincial Government and Politics
47.508	The Politics of Energy and the Environment
47.544	Public Administration in Developed Western Countries
47.545	Public Administration in Developing Countries
47.547	Decision Theories and Policy Studies
47.561	Analysis of Canadian Foreign Policy

Social Work

52.511	Social Policy Analysis
52.514	Housing Policy
52.515	Poverty and Wealth
52.540	Social Administration and Policy
52.541	Management of Social Programs
52.551	Program Evaluation

Sociology and Anthropology

53.525	Canadian Society
53.527	Sociology of Formal Organizations
53.529	Sociology of Science and Technology
53.532	The Labour Process
53.540	Political Sociology

53.549   The Politics of Social Movements and
          the State
53.568   Women and Work

University of Ottawa
ADM5320   Marketing
ADM5380   Management Decision Models
ADM6320   Marketing Research
ADM6340   Accounting for Managerial Planning
           and Control
ADM6352   Empirical Methods in Financial
           Economics
ADM6380   The Modelling of Management
           Decisions Under Uncertainty

Academic Standing

All candidates are required to obtain a grade of B−
or better in each course in the program. A candidate
may, with the recommendation of the School and
the approval of the Dean of the Faculty of Graduate
Studies and Research, be allowed a grade of C+ in
one full course.

Doctoral Program in Public Policy

The doctoral program in public policy has two
primary objectives:
- to contribute to the advancement of research and
  teaching based on one or more of the various
  approaches to the political economy of public
  policy (in OECD countries)
- to develop scholars and researchers for positions
  in universities, private research institutions and
  various other public and private organizations

While the School's M.A. degree outlined above offers
exposure to both policy and management, the Ph.D.
focuses directly on the study of public policy from
both Canadian and comparative perspectives. The
formation and evolution of policy in Canada is a
primary focus of the program. In addition, Canadian,
European and other international students interested
in research with a European-Canadian and North
American comparative perspective will also find the
program conducive to their work in the fields of
specialization offered. Areas of research special-
ization within the School include: policy institu-
tions and instruments, industrial policy, and social
and labour market policy.

A distinguishing feature of the School of Public
Administration is the presence of faculty who strive
to integrate political science and economics in their
research and teaching. The Ph.D. program is to a
considerable extent based on the view that political
economy is essential to an understanding of the
public sector. It is also based on the view that
analyses of what governments do must address the
interplay among the various policy fields, instru-
ments and institutions.

Degree Schedule

The program consists of three academic terms of
course work plus preparation for two comprehensive
examinations, as well as a doctoral thesis. *The
degree may not be taken on a part-time schedule.* A
limited number of Co-op placements, described
under the Master of Arts, may be arranged for Ph.D.
students.

Admission Requirements

Admission will be judged primarily on the
applicant's ability to conduct advanced research and
to complete the program successfully. Applications
should contain at least one essay or paper at the
M.A. level written by the applicant. Enrolment is
limited and possession of the minimum require-
ments does not, in itself, guarantee acceptance. To
be eligible for financial assistance, application for
admission for the fall term must be completed no
later than March 1.

Admission requires completion of an M.A. degree
in any of public administration, political science,
economics, political economy, business administra-
tion, law or similar degree with first class standing
(A− average or better in their M.A. work).

Applicants must also successfully complete
prerequisites in statistics, political science and
economics as described in detail below. These
prerequisites may be satisfied by the completion of
appropriate course work at the intermediate under-
graduate level or higher in each of the subjects listed.

Completed statistics courses should be approxi-
mately equivalent to courses Administration
50.551 and Administration 50.552 described under
Master of Arts, page 285. Candidates may, with
permission of the School, satisfy the statistics
prerequisites by completing these courses with at
least B+ standing during the first year of the Ph.D.
program.

Prerequisites in political science and economics
must be completed prior to entry. Completed
courses in political science should be approxi-
mately equivalent to Administration 50.567
and Administration 50.568, while completed
courses in economics should be approximately
equivalent to Administration 50.522 and Adminis-
tration 50.523. These courses are usually offered at
the School in the summer term and equivalent
courses may be taken at most universities through-
out the academic year. Applicants should seek
advice from the supervisor of the Ph.D. program
about whether particular courses are acceptable as
prerequisites.

Advanced Standing

Advanced standing will not normally be granted for any of the required courses described below. If granted, advanced standing will be limited to one full-credit course.

Program Requirements

The program consists of the following elements:
- ten half-credit courses
- preparation for and writing of two comprehensive examinations
- a thesis equivalent to five full-credit courses
- a language requirement

Course Component

Courses will normally be taken in the first year, and the fall of the second year. Students in the doctoral program are required to complete the following:

- the following seven half courses: Administration 50.604: Policy Fields, Instruments and Institutions I, 50.605: Policy Fields, Instruments and Institutions II, 50.506: The Political Economy of Public Policy I, 50.607: The Political Economy of Public Policy II, 50.608: Economics of Public Policy I, 50.609: Economics of Public Policy II, 50.610: Public Policy Research
- three half courses that permit the student to develop an area of specialization and which will be chosen by the student after consultation with, and approval by, the student's academic supervisors

These courses will normally include graduate courses offered by the School and by the Departments of Political Science and Economics. However, other courses will also be approved. Doctoral students taking courses at the master's level will be subject to enhanced course requirements. When necessary, students must arrange formal approval from the relevant department for admission to optional courses.

A grade point average of at least 9.0 (B+) must be obtained in the above courses before proceeding to the comprehensive examinations.

Comprehensive Examinations

Students will write a general comprehensive examination, normally in September of the second year. This examination will focus on material emanating from the required first year courses.

Students will also be examined on their chosen area of specialization in a second examination. For this comprehensive examination they will write one major essay on the field of specialization. This essay will be read by their examining committee and will be the subject of an oral examination to be held normally at the end of the second year. It is expected that the comprehensive essay will

critically review relevant literature, and may contain some initial thoughts regarding the student's Ph.D. thesis.

Preparation for the two comprehensive examinations will be assisted through tutorials as described below.

Thesis

Following the successful completion of the comprehensive examinations, students will prepare a formal thesis proposal under a committee composed of the supervisor and two other faculty members. The thesis supervisor will normally be a faculty member from the School of Public Administration. Each committee must consist of at least one political scientist and one economist. The thesis must demonstrate an advanced ability to integrate the politics and economics of public policy. The thesis must be defended at an oral examination.

Language Requirement

A reading knowledge of French will be required according to normal university Ph.D. language examination procedures. Another language may be substituted for French if it is essential for the thesis.

Required Courses — Master of Arts*

- Administration 50.500F1
Public-Sector Managing and the Canadian Political System
An examination of the central features and influences of the Canadian political systems on public service managerial and policy roles. An examination of the application of managerial concepts and approaches in Canadian public administration.

- Administration 50.510F1, W1
Management Accounting
An introduction to the underlying assumptions and basic principles of accounting, and an examination of the uses of accounting information by management. Topics include income measurement, asset valuation, financial statement analysis, cost systems, control reports, operating budgets, capital expenditure decisions, and alternative choice problems.

- Administration 50.511F1, W1
Financial Management
An examination of the principles and practice of financial planning and control. Analysis of the problems of resource allocation and asset management under conditions of uncertainty. Techniques

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* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

of capital expenditure analysis, and analysis of funds flow.
C.M. Carmichael.

• Administration 50.522W1
Macroeconomics for Management and Policy
An examination of macroeconomic theory and policy, with emphasis on the theoretical foundations of contemporary policy debates.
George Warskett and S.L. Winer.

• Administration 50.523F1
Microeconomics for Management and Policy
An examination of microeconomic theory and policy, with attention to public-sector economics.
A.M. Maslove, George Warskett, and S.L. Winer.

• Administration 50.525F1
The Canadian Economy
This course examines, in an integrated fashion, the economy of Canada, the history of Canadian economic policy, and major current economic policy debates. The central thrust of the course is to present the view of the Canadian economy as a system, stressing linkages among sectors and the consequences for economic (and social) policy. The central theme will be explored, in part, by focusing on selected topics and issues such as industrial structure, regionalism, federalism, trade policy, stabilization and the deficit debate, labour markets, and income redistribution.
Prerequisites: Administration 50.522 and 50.523.

• Administration 50.530F1, W1
Organizational Behaviour I
An examination of basic theories and approaches to the motivation of workers in organizations, the analysis of individual behaviour in organizations from the perspective of worker motivations, and the examination of current tools, such as job enlargement participation models and M.B.O. for improving worker motivation and coping with organizational change.
Prerequisite: Administration 50.500 or the equivalent.
D.G. Swartz and K.A.H. Graham.

• Administration 50.536F1, W1
Law of Public Authorities I
Introduction to basic legal principles, structures, and processes for the public administrator. Character of law and public law; constitutional framework; legal sanctions and basic principles of legal control. Statutory discretion from the administrator's point of view.
R.D. Abbott.

• Administration 50.551F1
Quantitative Methods I
An introduction to the theory of measurement and various methods of data collection, causal analysis and inferential statistics.
Eugene Swimmer, George Warskett, and S.L. Winer.

• Administration 50.552F1, W1
Quantitative Methods II
An examination of techniques and problems of single equation estimation. Students will be expected to devise their own research design and analyze quantitative data with the use of the computer.
Prerequisite: Administration 50.551.
Eugene Swimmer, George Warskett, and S.L. Winer.

• Administration 50.567F1, W1
Political Economy of the State
An examination of basic theories and interpretations regarding the roles of, and interrelationships among, the state, corporations, labour unions, the professions, and other elements of the private sector.
Rianne Mahon, F.D. Abele, and D.G. Swartz.

• Administration 50.568F1, W1
Policy and Decision Making
An introduction to major political, economic, and organizational theories of policy and decision making, and their relationship to applied policy analysis.
Prerequisites: Administration 50.500 or the equivalent and 50.567.
G.B. Doern, Rianne Mahon.

• International Affairs 46.507F1
Theories of Development and Underdevelopment
A comparative analysis of approaches to the study of development processes and underdevelopment, including structural-functional, neo-classical, Marxist, and dependency theories.

• International Affairs 46.508W1
Development Planning: Theory and Practice
Third World development plans and strategies and their impacts; techniques employed in development planning, including social cost-benefit analysis, budgeting, and problems in development administration.

• International Affairs 46.537W1
Macroeconomics in a Development Context
An examination of macroeconomic theory and policy in the context of the developing countries, with special emphasis upon theory and policy for open economies, structural adjustment to international disequilibration, exchange rate and balance of payments management, fiscal and financial policy.

Optional Courses — Master of Arts

Note: Optional courses may only be taken when the student has completed at least nine required half-credit courses or has obtained advanced standing in same.

• Administration 50.502F1
The Political Economy of Regulation
An examination of political, economic, legal, and organizational theories of regulation in the Canadian and comparative context, and of the processes and consequences of regulatory practice in selected Canadian public policy fields.
Prerequisite: Administration 50.568.

• Administration 50.503F1 or W1
Policy and Administration in Intergovernmental Relations
An examination of the major cost-sharing and fiscal transfer agreements, and the intergovernmental mechanisms for policy and administrative coordination in selected policy fields.

• Administration 50.513F1
Budget Decision Making and Budgeting
A study of selected aspects of the expenditure and revenue budget and budgetary process at all levels of government. Student papers are oriented towards critical review of actual budgets and budgetary processes.
Prerequisites: Administration 50.523 and 50.568.
A.M. Maslove and S.L. Winer.

• Administration 50.514W1
Public-Sector Accounting and Finance
An examination of selected problems in accounting and financial management in public-sector organizations.

• Administration 50.515F1
Management in the Public Service
An examination through cases and research of selected problems and issues in public service management. The specific focus of the course will change each year; some topics include human resources management, government investment, and pricing decisions.

• Administration 50.516W1
Urban and Local Government Management
An analysis of the principal issues and processes of Canadian urban and local government management and administration.
K.A.H. Graham.

• Administration 50.517W11
Public Management in Developing Countries
An applied analysis of selected issues in public management and administration in developing countries.
N.H. Lithwick.

• Administration 50.518W1
Marketing for Non-Profit Organizations
Examination of the concepts of marketing relative to public demand, and the market for social goods and services. Contemporary marketing approaches and practices are analyzed and applied to purposes, programs, and environments of government agencies and departments, educational institutions, charities, and other public and social services.

• Administration 50.519W1
Management of Public Enterprise
An examination of the theory and practice of public enterprise, drawing on both Canadian and comparative experience. The seminar examines selected federal and provincial crown corporations, and mixed enterprises, such as Air Canada, CNR, AECL, Telesat Canada, and the Canada Development Corporation.

• Administration 50.520F1
Public-Sector Investment and Pricing
An examination of theory and practice related to decision making about public-sector investment and pricing policy, particularly in connection with large-scale projects and programs. The focus is applied cost-benefit analysis (discount rates, marginal cost and shadow pricing, and the handling of risk and uncertainty) in large-scale public investment choices.
Prerequisite: Administration 50.523.
A.M. Maslove and S. L. Winer.

• Administration 50.524F1
Advanced Microeconomics for Policy Analysis
A course in microeconomics to provide advanced analytical tools to address policy issues in areas such as industrial organization, labour economics, public finance, regulation, and international trade.
Prerequisite: Administration 50.523.
S.L. Winer.

• Administration 50.528F1, W1
Management Information Systems I
An examination of the fundamentals of MIS: the nature of systems, information, and management processes, including concepts of data-processing technology, systems design, organizational impacts of information systems, and hardware and software considerations.

• Administration 50.529W1
Management Information Systems II
The objective of this course is to provide the student with the tools to become an intelligent user and manager of an information system. Topics include: structured systems analysis and design; technology assessment; data analysis and design; and systems development life cycle. Students are required to present the results of a major case study of an information system.
Prerequisite: Administration 50.528.

• Administration 50.531W1
Organizational Behaviour II
An examination of macro open-systems theories of behaviour of organizations, including interagency and agency-clientele relations and accountability processes. Students examine through research papers different modes of organization, including ministry systems, state enterprise, mixed enterprise, regulatory boards, and service and custodial organizations.

• Administration 50.537F1
Law of Public Authorities II
An examination of characteristics and selected problems of control of administrative action. Topics include: varieties of traditional and constitutional, legal and judicial control, impact of the Charter, reforms to administrative law control systems in Canada, and comparisons with developments outside Canada.
Prerequisite: Administration 50.536.

• Administration 50.538W1
The Management of Provincial Government
A comparative analysis of public-sector management structures and processes at the provincial level of government. Topics examined include personnel and financial systems, regional administration, public utilities, direct interprovincial program and project management, and international activities of provinces.
Prerequisites: Administration 50.500 or the equivalent.

• Administration 50.560F1, W1
Industrial Policy: Theory and Practice I
An examination of the economic factors which enter into the Canadian industrial policy debate. The course seeks to develop an appreciation of the ways in which different economic facts and methodologies lead to different conclusions regarding the proper objectives of Canadian industrial policy. It will examine the different positions in that debate and explore the various ways in which they draw on theory, history and comparative studies to establish their respective conclusions.

• Administration 50.561F1
Industrial Policy: Theory and Practice II
An examination of the main policies, programs and strategies of government departments, federal and provincial, for economic development, with emphasis on Canada.

• Administration 50.562F1, W1
Planning and Evaluation in Government I
An examination of selected concepts, issues, and processes in applied governmental planning and evaluation, utilizing both Canadian and comparative experiences.
F.D. Abele.

• Administration 50.563F1, W1
Qualitative Research in Public Organizations
The course deals with the specification and formulation of research problems, and with the design and conduct of qualitative social research in public sector settings. There is emphasis on tactics to control and summarize information throughout the life of a study, and on techniques for the reduction and presentation of non-quantitative data. Writing and communication skills are stressed. The skills gained are relevant to a number of kinds of analysis typically conducted in bureaucracies, such as program evaluation designs and studies, and implementation analysis.
Prerequisite: Administration 50.562.

• Administration 50.564F1
Social Policy
A seminar which will study the nature and historical development of social programs and the welfare state in capitalist countries, with particular focus on Canada. The course will concentrate on developing a critical understanding of the social forces shaping these programs and evaluating the implications of current debate on the future of social policy in Canada.

• Administration 50.566S1
Science and Technology Policies
An examination of Canadian programs, policies, and strategies toward the development of scientific and technological capability, and towards the use of science and technology in social and economic programs.

• Administration 50.569W1
Public Choice: Theory and Application
Understanding the public sector through the building and application of public choice models. Topics include the theory of groups, representative democracy, special interest politics, the bureau, and federal structure.
Prerequisite: Administration 50.523.
A.M. Maslove and S.L. Winer.

• Administration 50.570T2
Policy Seminars
An examination of one or more selected policy
areas. The focus will be an analytical assessment of
the selected policy area in terms of its many-sided
economic, political, social, legal, quantitative, and
administrative complexities. The policy field will
change each year.

• Administration 50.571F1, W1
Gender and Public Policy
An examination of policy and policy making as
they pertain to gender relations within the state as
well as in society at large. The course looks at the
negative and positive effects of public policy on
gender relations in the family and the labour market.

• Administration 50.572F1, W1, 50.573S1
Policy Seminars
An examination of one or more selected policy areas.
The focus will be an analytical assessment of the
selected policy area in terms of its many-sided
economic, political, social, legal, quantitative, and
administrative complexities. The policy field will
change each year.

• Administration 50.574F1
Regional Policy
This seminar examines the theory and practice of
regional policy, using the Canadian experience as a
case study. It begins with an analysis of regionalism
and regional economic concerns. Then the alternative
policy approaches that are available and their
theoretical underpinnings are considered, and a
critical review of Canadian efforts is undertaken.
Particular emphasis is placed on the way in which
federalism shapes perceptions of regional issues, and
influences the approach to solutions. Regional
development concerns in the Third World countries
may be analyzed in brief if students from that region
participate.
N.H. Lithwick.

• Administration 50.575F1
Advanced Statistical Policy Analysis
An examination of econometric research on selected
policy issues. The issues considered vary each year
and the analysis incorporates the study of selected
econometric techniques. The course enables students
to evaluate critically applied econometric studies of
public policy.
S.L. Winer and George Warskett.

• Administration 50.581W1
Human Resources Management
An introduction to the field of human resources
Management including the roles of human resource
departments, employee motivation, staffing,
compensation, benefits, training and development
and employee relations.

• Administration 50.583F1
Problems in Organizational Change and
Development
An examination, through case work and group pro-
jects, of the concepts and issues of planned organi-
zational changes.
Prerequisite: Administration 50.530.

• Administration 50.584F1
Industrial Relations and Collective Bargaining
An analysis of the basic concepts of industrial
relations, with respect to both public- and private-
sector employees and organizations.
Eugene Swimmer.

• Administration 50.585W1
Public-Sector Collective Bargaining
An application of the basic concepts, legislation,
and public policies regarding public-sector collective
bargaining at the federal, provincial, and municipal
levels of Canadian government. Cases and simulated
negotiations will be used where appropriate.
Prerequisite: Administration 50.584.
Eugene Swimmer.

• Administration 50.590T2
Directed Studies
A tutorial or directed reading course on selected
subjects.

• Administration 50.591, 50.592, 50.593F1,
W1, S1
Directed Studies
A tutorial or directed reading course on selected
subjects.

• Administration 50.597T2
Special Project in Development Administration

• Administration 50.598F2, W2, S2
Research Essay

• Administration 50.599F4, W4, S4
M.A. Thesis

Required Courses — Ph.D

Note: All courses are half-credit (one-term) courses
unless otherwise indicated. Ph.D. courses are open
to master's students with approval of the School.

• Administration 50.604F1
Policy Fields, Instruments and Institutions I
An examination of comparative and Canadian theo-
ries and analyses of policy fields, instruments and
institutions, with emphasis on selected fields
(including social, labour market and industrial

policy) and instruments (including public expenditure, taxation and regulation.)
Before 1994-95 course 50.604 was offered as 50.600.

• Administration 50.605W1
Policy Fields, Instruments and Institutions II
An examination of different approaches to understanding the roles of ideas, interests and institutions in the policy process from a political science perspective. Topics may include discourse coalitions, policy learning, neo-institutionalism, policy communities, citizenship, community and contemporary challenges to democratic government.
Before 1994-95 course 50.605 was offered as 50.600.

• Administration 50.606F1
The Political Economy of Public Policy I
An examination of various structural approaches to the political economy of public policy, including institutional, marxist and other broad frameworks. Emphasis is placed on the contribution of these approaches to our understanding of social and economic changes and the role of public policy in shaping them.
Before 1994-95 course 50.606 was offered as 50.601.

• Administration 50.607W1
The Political Economy of Public Policy II
An examination of the microanalytic foundations of the political economy of public policy, with application to selected policy issues. Topics covered may include welfare economics and public goods, group formation, collective choice mechanisms, voting behaviour, the evolution of institutions and norms, principal-agent problems and bureaucracy.
Before 1994-95 course 50.607 was offered as 50.601.

• Administration 50.608F1
Economics of Public Policy I
An examination of advanced topics in microeconomic theory, including consumption, production and industrial organization, with application to selected policy issues.
Before 1994-95 course 50.608 was offered as 50.602.

• Administration 50.609W1
Economics of Public Policy II
Selected application of economic theory to various contemporary public policy problems and issues. Topics chosen for study will vary from year to year. Emphasis is placed on the presentation by students of critical analyses of relevant literature.
Before 1994-95 course 50.609 was offered as 50.602.

• Administration 50.610F1, W1, S1
Public Policy Research
An examination through analyses of selected current research projects of basic applied research issues, philosophies and problems in public policy research.
Before 1994-95 course 50.610 was offered as 50.603.

• Administration 50.690F3, W3,S3
Ph.D. Tutorial
A tutorial specifically designed as preparation for the general comprehensive examination, under the direction of two or more faculty members. The grade to be awarded will be that obtained on the general written examination.

• Administration 50.691, 692, 693F3, W3,S3
Ph.D. Tutorials
Ph.D. tutorials specifically designed as preparation for the applied specialization examination. Working under the direction of two or more faculty members, the selected tutorial includes the preparation of a major literature review essay. The essay must be defended in an oral examination. The grade to be awarded is that obtained on both the written essay and the oral defence.

• Administration 50.699F10, W10, S10
Ph.D. Thesis
Students will normally be supervised by faculty in the School of Public Administration but may also seek supervision from faculty in other social science departments, schools and institutes.

School of Social Work

St. Patrick's Building 469
Telephone: 788-5601
Fax: 788-7496

The School

Director of the School:
Gillian Walker
Supervisor of Graduate Studies:
To be announced

The School of Social Work, accredited by the
Canadian Association of Schools of Social Work,
offers a graduate program leading to the degree of
Master of Social Work. The program may normally
be completed in 12 months of full-time study. Part-
time study is also offered and may normally be
completed in three to four years.

**Note: The new one-year Master of Social Work
program is to be offered, subject to the approval
of the Ontario Council on Graduate Studies, in
the academic year 1995-96.**

Master of Social Work

The Master of Social Work program is based on an
analytical and critical approach to social work
practice, and to knowledge related to practice. The
program examines the structural context of personal
and social problems, and of social work practice.
The structural context refers to the interaction
between individuals and the social, political, and
economic aspects of society. The program focuses
on the development of forms of practice predicated
on this notion, seeking to intervene to change the
nature of the interaction between people and their
structural contexts.

The orientation of the School explicitly includes
approaches to social development and social
change which involves working directly with indi-
viduals, groups and communities. This includes a
strong emphasis on sensitivity to the individual, and
on the development of new and innovative strategies
for working with individuals in the context of their
everyday lives. The School also stresses community
analysis and an awareness and knowledge of the
social policies that affect the lives of all people in
our society. Analysis of class, gender and race is
considered central to the curriculum.

The School of Social Work is committed to educa-
tional equity. The society in which we live and of

which social work is a constituent part is composed
of groups of people distinguished by their differential
access to power — economic, political and social.
The School affirms the principle that all these
groups should have the opportunity to learn in a
supportive environment. Educational equity is
consistent with a continuing commitment to meet-
ing high standards of academic and practice compe-
tence.

The central purpose of the graduate program is to
provide the opportunity for those already active in
the broad field of social work to build on their
knowledge and experience. Students will be able to
use the program to deepen their understanding of
both methods and context of practice, to build new
knowledge, and to apply this new knowledge in a
practical way. The program requirements are
designed to be as flexible as possible. Research will
be required of every student. Otherwise, the course
of study for each student will depend on individual
study plans that build on previous academic and
practice experience. Graduates may expect to use
their experience in the School as the basis for
continuing to expand their personal knowledge in a
society undergoing rapid change.

Admission Requirements

Applicants to the master's program will normally
have received an accredited Bachelor of Social
Work degree with high honours standing, and have
had several years of social work or related experi-
ence. Candidates in the final year of a Bachelor
of Social Work program may be considered if
they have substantial social work or related experi-
ence. Experienced applicants who hold undergrad-
uate or graduate applied social science degrees from
a university or technical institute outside North
America may apply. The School will review the
equivalence of such degrees to a Bachelor of Social
Work.

Persons with a Bachelor of Arts degree and
human service experience are directed to apply to
the Bachelor of Social Work program. If accepted
in the Bachelor of Social Work program, candidates
may receive advanced standing to allow them to
complete the Bachelor of Social Work degree
in two years. Please refer to the *Undergraduate
Calendar* for further information.

Admission to the School is on a selective basis
and is guided by our objectives with respect to
educational equity. Persons who typically are
denied equal access to power — economic, political

and social — are encouraged to apply. This includes, but is not limited to, persons of aboriginal and racial, cultural, and/or ethnic minority origin, persons with disabilities, lesbian, gay, and bisexual persons, and persons disadvantaged by their gender or economic condition.

Applicants must have completed one credit in research methods in their undergraduate program. Upon admission, applicants who have completed graduate work in a related discipline may be considered for advanced standing according to the Transfer of Credit requirements of the Faculty of Graduate Studies and Research. Work experience may not be substituted for research or other academic requirements including the field practicum.

Candidates are advised to apply by October 15 for admission in September of the following year.

Note: Only students in the second year of the existing graduate program will be registered in the fall of 1994.

Part-Time Studies
The School offers part-time studies to qualified candidates who, due to a range of circumstances, cannot participate in a program of full-time study. The requirements for part-time studies are identical to the regular program except that part-time students are limited to a maximum of one credit of course work per term.

Students registered on a part-time basis must maintain continuous registration for a minimum of two terms per year until all course requirements are completed. Students choosing the thesis option must maintain continuous registration in accordance with the regulations of the Faculty of Graduate Studies and Research. The number of part-time students admitted in any given year may vary.

Part-time students must register in the Educational Planning and Integration Seminar (52.536) plus the equivalent of one-half credit of course work in their first fall term.

Change of Status
Students may change from part-time status to full-time, or from full-time to part-time with the permission of the Supervisor of Graduate Studies and the Faculty of Graduate Studies and Research. Students wishing to take a leave of absence should consult the regulations of the Faculty of Graduate Studies and Research. Individual Study Plans must be amended to reflect changes in status.

Program Requirements
Candidates for the Master of Social Work degree must complete six full credits of course work or the equivalent.

Students are expected to select a substantive area which will be addressed in a program of study which balances and links foundation knowledge for social work and applied knowledge in social work. In order to graduate, a student must demonstrate both conceptual and practice skills.

All students must complete a one credit course in Research Methods for Social Work (52.545), a one credit Educational Planning and Integration seminar (52.535), and two credits of course work which are taken by registering in 52.550. One-half credit may be taken outside the School. Students choosing to take one-half credit outside the School will complete one and one-half credits of course work by registering in a combination of 52.553 - 52.558. Part-time students may also complete this requirement by registering in 52.559.

The remaining two credits will be taken by choosing *one of* a field practicum (52.560), a community practice project (52.565), *or* a thesis (52.599).

Requirements for students completing the two year Master of Social Work program will be established on an individual basis. Completion of a field practicum and either a thesis or an Independent Enquiry Project (52.590) will continue to be required.

Study Plans
Each student's program will be set out in detail in a study plan. During the first two to three weeks of the fall term, the Educational Planning and Integration Seminars (see 52.535) will be devoted exclusively to assisting students in the development of these plans. Initial study plans must be approved by the student's faculty advisor by the last date for course changes for fall term courses. The study plan constitutes an agreement between the student and the School and must contain reference to all academic and practicum work to be undertaken. It will provide a reference point to ensure that a student's program includes all of the elements required for graduation set out under program requirements above. The initial study plan and any subsequent changes must be approved by the Supervisor of Graduate Studies.

Academic Standing
The School operates within the evaluation and grading system of the Faculty of Graduate Studies and Research.

Graduate Courses*

The School of Social Work strives to integrate an analysis of race, class and gender, heterosexism, ableism and ageism in its course offerings through a continuous process of curriculum review and development.

• Social Work 52.535T2
Educational Planning and Integration Seminar
All students will be assigned to group seminars. The seminar will be used initially for development of learning objectives, selection of study options and articulation of individual study plans. The seminar will also provide ongoing opportunity for presentation and discussion of issues related to social work practice that arise out of each student's work, as well as identification of new learning objectives. Proposals for changes in individual study plans must be addressed within the seminar as part of the approval process.

• Social Work 52.536, 52.537F1,W1
Educational Planning and Integration Seminar
Same description as 52.535

• Social Work 52.545F2
Research and Evaluation in Social Work
Research and evaluation are political, theoretical and philosophical as well as technical activities. This course examines the debates between differing research paradigms, their approaches to knowledge, their contributions to evaluation of social work practice and their potential linkages. It will enable students to understand the inquiry process and to understand different ways of creating and understanding knowledge. Students will be expected to develop a research proposal related to their choice of a thesis, field practicum, or community project.

• Social Work 52.546W1
Research and Evaluation in Social Work
This course is the first half of 52.545.

• Social Work 52.547F1
Research and Evaluation in Social Work
This course is the second half of 52.545.
Prerequisite: Social Work 52.546.

• Social Work 52.550T4
Studies in Social Work
Course work in the School of Social Work is comprised of a variety of educational offerings and includes practice seminars, directed studies, workshops, independent study, and community projects as well as lecture courses. Except for lecture courses these are referred to as study units and weighted according to actual or estimated contact hours between instructor and student. One credit equals 12 units of study. Students will select a combination of study units and lecture courses over two terms equalling 24 units. (See below for a general description of the alternative ways in which study units are organized). Study units selected for completion of this requirement must be included in the student's approved plan of study.

• Social Work 52.553, 554F2,W2
Same description as 52.550 at 12 units of course work per term. The fall term will not be available to part-time students in the first year of registration.

• Social Work 52.555, 52.556, 52.557, 52.558F1,W1,S1
Same description as 52.550 at six units of course work per term.

• Social Work 52.559T1
Same description as 52.550 at six units over two terms. Not available to full-time students.

• Social Work 52.560W4,S4
Field Practicum
The Field Practicum facilitates the integration of academic and practical aspects of social work education. The practicum is designed to be a form of guided learning, providing students with an opportunity to apply, test and develop theory and practice skills in the practical, everyday realities of social work. Students are expected to build on, and to go beyond, their present knowledge and skills. It may be in a familiar area of practice or it may be entirely new to the student. It is intended that there shall be a wide range of options available, so that students may design a practicum to meet their needs. A field seminar may be included.

• Field Practicum 52.561F2,W2,S2
Same description as 52.560. Students must register for this course in two consecutive terms. May not be initiated in the first fall term of registration.

• Field Practicum 52.563F1,W1,S1
Same description as 52.560. Students must register for this course in four consecutive terms.

- Social Work 52.565T4
Community Practice Project
The Community Practice Project combines classroom instruction, social research, and community work practice. It requires the combination of the practice skills of a social work practicum and the research skills of a thesis. It is based both in the classroom and in the community. The broad purpose will be to develop and implement a community based project that addresses issues of social justice for those disadvantaged by social inequalities. This option will be offered subject to sufficient registration.

- Social Work 52.570, 52.571, 52.572, 52.573F1,W1,S1
Special Topics in Social Work
The School will offer lecture courses on substantive topics related to social work and social welfare. Topics will vary each year depending on the interests of faculty and students. Students from outside the School of Social Work may register with permission of the School.

- Social Work 52.590F2,W2,S2
Independent Enquiry Project
This course is available only for those students registered in the previous two-year program. (See 1993-94 *Graduate Calendar* for description).

- Social Work 52.592F4,W4,S4
Thesis
This course is available only for students completing a thesis under the previous two-year program.

- Social Work 52.599F4,W4,S4
Thesis
Students selecting this option should familiarize themselves with the Faculty of Graduate Studies and Research handbook for thesis and dissertations.

Study Units

Social Work Practice Seminars (6 units)
Applied knowledge for social work practice will be addressed in small group seminars utilizing "Enquiry and Action Learning" methods. This method uses examples drawn from the experience of social work practitioners and relies on self-guided study individually, and as a group, under the direction of a faculty tutor. The seminar provides for building on the experience of individuals in the group, as well as mutual learning, and shared experience. The substantive area of practice will vary depending on student interest. The emphasis is on practice methodologies rather than accumulating information.

Directed Studies-Group (3-12 units)
Exploration of selected theoretical perspectives relevant for social work practice. Arranged for small groups of students who are interested in a similar substantive area.

Directed Studies-Individual (3-12 units)
Exploration of selected theoretical perspectives relevant for social work practice. This option is for individual students whose interests coincide with, and who wish to work under the direct supervision of, a member of faculty or visiting scholar. (Subject to availability of faculty).

Special Seminars in Social Work (6 units)
Students may participate in a fourth year Bachelor of Social Work course. Supplementary reading and/or work will be required for credit at the graduate level. Supplementary requirements must be approved by the course instructor and the Supervisor of Graduate Studies.

Workshop on Selected Topics in Social Work Practice (1-6 units)
Participation in approved workshops offered by the School or in the community may be possible from time to time. Unit weight will depend on number of contact hours and requirements for evaluation.

Independent Study (3-12 units)
Individually arranged studies. This option must be based on a written proposal and approved by the Supervisor of Graduate Studies. Proposals must include learning objectives, practice objectives where relevant, method, time of completion and criteria and method for evaluation. Course weight up to a maximum of 12 units will vary according to estimated time for completion.

Community Practice (3-6 units)
Short term community projects supervised by faculty may be undertaken based on a written proposal and approved by the Supervisor of Graduate Studies. Proposals must include learning objectives, practice objectives, time of completion, and criteria and method for evaluation. (Subject to availability of faculty).

Department of Sociology and Anthropology

Loeb Building B750
Telephone: 788-2582
Fax: 788-4062

The Department

Chair of the Department:
Florence Andrews
Coordinator of Graduate Programs in Sociology:
John de Vries
Coordinator of the Graduate Program in Anthropology:
Jared Keil

The Department of Sociology and Anthropology offers programs of advanced study and research leading to the M.A. and the Ph.D. degrees in Sociology, and the M.A. in Anthropology.

The principal focus of the graduate programs in sociology is the organization and development of contemporary societies in comparative context and with particular reference to Canadian society. Specializations in theory and methodology, social stratification and power, cultural and gender studies, and in comparative institutions are offered.

The anthropology program focuses on the social and cultural Other, including its popular and scholarly representations, through current emphasis on three program concentrations: (a) the anthropology of signs and symbols; (b) North American native studies; and (c) the anthropology of development and under-development.

The department strives to achieve a blend of research and formal graduate instruction in its graduate programs.

Qualifying-Year Program

Applicants with general (pass) bachelor's degrees may be admitted into a qualifying-year program designed to raise their standing to honours status. Students earning at least high honours standing in their qualifying-year courses will be considered for admission into the master's program.

Refer to the general section of this calendar for details of the regulations governing the qualifying year.

Master of Arts in Sociology

Admission Requirements
The requirement for admission into the master's program is an honours B.A. (or the equivalent) with at least high honours standing. Where relevant, previous professional experience will be taken into account in determining an applicant's standing on admission.

The deadlines for submitting applications and supporting documents for graduate study in sociology are as follows: February 1 for students requesting financial assistance; July 1 for students not requesting financial assistance but who are seeking admission in September; and November 1 for students who are seeking admission in January.

Program Requirements
Master's students in sociology are required to select and follow one of the optional program patterns below, chosen in consultation with a graduate adviser:

Thesis Program
- Three full courses (or the equivalent); under certain circumstances one of the courses may be selected from those offered at the senior undergraduate level. Sociology 53.589 is highly recommended, especially for students who at the time of registration have not decided on a thesis topic
- A thesis equivalent to two full-course credits
- An oral examination on the candidate's thesis and program

Course Work Program
- Five full courses (or the equivalent) excluding Sociology 53.595; under certain circumstances one of the courses may be selected from those offered at the senior undergraduate level
- Written and oral comprehensive examination in the candidate's area of specialization and program

Transfer from thesis to course work M.A.
Students who choose to change from the thesis to the course work program must normally do so before registering for a third term after initial, full-time registration, or before registering for a fifth term after initial part-time registration.

Academic Standing

A grade of B– or better must normally be obtained in each course counted toward the master's degree. With the recommendation of the department, and permission of the Dean of the Faculty of Graduate Studies and Research, a candidate may be allowed a grade of C+ in one full course or each of two half courses.

Master of Arts in Anthropology

Admission Requirements

The requirement for admission into the master's program is an honours B.A. (or the equivalent) with at least high honours standing. Where relevant, previous professional experience will be taken into account in determining an applicant's standing on admission.

The deadlines for submitting applications and supporting documents for graduate study in anthropology are as follows: February 1 for students requesting financial assistance; July 1 for students not requesting financial assistance but who are seeking admission in September; and November 1 for students who are seeking admission in January.

Program Requirements

Master's students in anthropology are required to select and follow one of the optional program patterns below, chosen in consultation with a graduate adviser:

Thesis Program

Three full courses (or the equivalent) to include:
- Anthropology 54.541 (normally to be taken in the first fall term after admission to the program)
- Anthropology 54.542
- Two additional credits selected from the anthropology graduate course offerings; from courses offered in the sociology graduate program (especially in theory and methods, or in areas which relate to the student's thesis research interests); from 400-level courses offered in the sociology and anthropology undergraduate program (with permission of the graduate committee); or any combination of these selected in consultation with the student's graduate adviser. Courses in other programs in the university may also be selected, especially if they relate to the student's proposed thesis research, but normally not in excess of one full course (or the equivalent)
- A thesis equivalent to two full-course credits
- An oral examination on the candidate's thesis and program

Course Work Program

Five full courses (or the equivalent) excluding Anthropology 54.595, consisting of:
- Anthropology 54.541 (normally to be taken in the first fall term after admission to the program)
- Anthropology 54.542
- Four additional course credits as described in the thesis program above, chosen in consultation with the student's graduate adviser
- A written and oral comprehensive examination in the candidate's area of specialization and program

Transfer from thesis to course work M.A.

Students who choose to change from the thesis to the course work program must normally do so before registering for a third term after initial, full-time registration, or before registering for a fifth term after initial part-time registration.

Academic Standing

A grade of B– or better must normally be obtained in each course counted toward the master's degree. With the recommendation of the department, and permission of the Dean of the Faculty of Graduate Studies and Research, a candidate may be allowed a grade of C+ in one full course or each of two half courses.

Doctor of Philosophy in Sociology

The substantive focus of the Ph.D. program is the organization and development of contemporary societies, both in a comparative context and with particular reference to Canadian society.

The Ph.D. program in sociology normally will be undertaken on a full-time basis; however in exceptional cases the department will consider admission on a part-time basis.

Admission Requirements

The minimum requirement for admission into the Ph.D. program is a master's degree (or the equivalent) in sociology, normally with a minimum average of B+ in courses (including the thesis where applicable), and with no grade below B.

Applicants who have deficiencies in certain areas may be admitted to the Ph.D. program, but will normally be required to complete additional course work.

The deadlines for submitting applications and supporting documents for admission into the Ph.D. program in sociology are as follows: February 1 for students requesting financial assistance; July 1 for students not requesting financial assistance but who are seeking admission in September; and

November 1 for students who are seeking admission in January.

Program Requirements

The specific program requirements of the Department of Sociology and Anthropology are the following:

- ten full courses (or the equivalent), including 53.600, and a dissertation equivalent to a maximum of seven full courses or a minimum of five full courses
- Written and oral comprehensive examinations in three areas of specialization
- Presentation of a dissertation proposal
- Language requirements as stated below
- An oral defence of the dissertation

Comprehensive Examinations

Each Ph.D. candidate is required to write comprehensive examinations in three of the following areas:

- Theory and Methodology
- Stratification and Power
- Cultural Studies
- Comparative Institutions

At least one but not all three of the examinations must be in the area of STRATIFICATION AND POWER.

Subjects of instruction and research subsumed under these four areas are:

1. Theory and Methodology
- Logic of Social Scientific Enquiry
- Classical Social Theories
- Contemporary Social Theories
- Feminist Theories
- Research Methodology

2. Stratification and Power
- Occupations and Formal Organizations
- Class Analysis
- Labour Process
- Political Sociology
- Race and Ethnic Relations
- Gender Relations
- Social Stratification and Mobility

3. Cultural Studies
- Ideology, Religion
- Communication and Popular Cultures
- Socialization and Education
- Ethnographic Areas
- Discourse Analysis

4. Comparative Institutions
- Canadian Society
- Socio-linguistics
- Population Studies
- Social and Economic Development
- Deviance, Law, and Criminal Justice

Upon petition to the sociology graduate programs coordinator, an approved field in sociology or a related discipline may be substituted for one of the options above. The subjects of instruction and research subsumed under each of the areas are indicative, and may be subsumed under more than one area, depending on the analytic approach adopted.

The comprehensive examinations are to be completed after course requirements for the Ph.D. have been completed. Normally comprehensive examinations must be completed no later than two years or six terms after initial full-time registration and four years or twelve terms after initial part-time registration.

The dissertation proposal is to be presented after comprehensive requirements have been completed. Normally the dissertation proposal must be presented no later than two and one-half years or seven terms after initial full-time registration and five years or fifteen terms after initial part-time registration.

Language Requirements

The Department of Sociology and Anthropology requires each Ph.D. candidate to demonstrate an understanding of a language other than English. Although French is the preferred second language, students may be permitted to substitute another language if it is demonstrably relevant to their professional interests. It is strongly advised, however, that all English-speaking candidates be proficient in French. The language requirements may be satisfied by a demonstration of reasonable understanding, on sight, of material contained in selected samples of sociological literature in that language. Students may find it necessary or advisable to take a course in the required language before undertaking the departmental language examination.

Academic Standing

Candidates must obtain a grade of B– or better in each course, and Satisfactory on the comprehensive examinations, the Ph.D. dissertation and its oral defence.

Graduate Courses*

The following is a complete list of all sociology and anthropology graduate courses. Please note that not all courses are offered every year. Students should consult the university and departmental timetables for a list of courses offered in 1994-95 and their scheduling.

* F,W,S indicates term of offering. Courses offered in the fall *and* winter will be followed by T.
The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- Sociology 53.500F1 or W1
Classical Sociological Theory
The course focuses on crucial sociological concepts and ideas proposed by the founders of sociology. Particular attention will be given to the contributions of Marx, Weber, and Durkheim; plus others such as Pareto, Comte, and Husserl. These will be situated within the philosophical, epistemological and social changes brought about by industrialization.

- Sociology 53.501F1 or W1
Selected Topics in Classical Theory
Topic varies from year to year.
Students should check with the Department regarding the topic offered.

- Sociology 53.502F1 or W1
Contemporary Sociological Theory
The seminar will provide an analysis of major theoretical perspectives in sociology, including social behaviourism; social action theories such as symbolic interactionism, phenomenological sociology, ethnomethodology; and structuralist theories such as structural functionalism, neo-Marxism and critical theory. The seminar will focus on certain methodological and philosophical issues relevant to the analysis of the perspectives.

- Sociology 53.503F1 or W1
Selected Topics in Contemporary Theory
Topic varies from year to year.
Students should check with the Department regarding the topic offered.

- Anthropology 54.504F1 or W1
Ecological Anthropology
This course examines anthropological approaches to the study of human environment relationships and to current problems of ecological degradation affecting native societies around the world. Topics covered include the influence in anthropology of ecological models borrowed from biological evolutionary theory and studies of non-human species. The implications of ecological analyses for the making of environmental policies will also be considered.

- Sociology 53.507F1 or W1
Social Change and Economic Development
A critical examination of studies of change and development in historical and contemporary national and transnational systems.

- Sociology 53.509F1 or W1
Philosophy of Social Science I
The seminar considers the philosophy of language and the basic elements of scientific method, such as the classification of the sciences, the concepts of

value, cause and probability, induction and deduction, confirmation of hypotheses, and the concept of truth.

- Sociology 53.511T2
Research Design and Data Analysis
An integrated approach to the problems involved in the analysis of quantitative data, research design and procedures. This course covers a comprehensive range of methodological issues from research design to data analysis, including the communication of results, sources of data and an ability to assess scholarly literature. The course includes the formulation of research questions, survey questions, use of archival data and case studies.

- Sociology 53.512F1 or W1
Statistical Methods I
A course on multiple regression analysis, with a review of basic statistical assumptions and techniques, followed by a detailed discussion of multiple regression analysis as a statistical technique. Particular attention will be paid to the practical problems associated with regression analysis of sociological data.

- Sociology 53.513F1 or W1
Statistical Methods II
The focus will be advanced research methods. Topics will include distributions, sampling distributions, hypothesis testing, and non-parametric methods. There will be an introduction to multivariate techniques, including regression and loglinear models.

- Sociology 53.514F1 or W1
Multivariate Analysis
This course provides advanced instruction in methods and statistics. Consideration will be given to multiple regression, factor analysis, canonical analysis.

- Sociology 53.515F1 or W1
Selected Topics in Social Research
Topic varies from year to year.
Students should check with the Department regarding the topic offered.

- Anthropology 54.516F1 or W1
North American Native Studies
An examination of selected issues in Canadian Indian, Inuit, and Métis history. The course will explore debates over social change, cultural autonomy, native rights, and government policy.

- Anthropology 54.517F1 or W1
Problems in North American Ethnohistory
This seminar will examine methodological and substantive problems in the history of Canadian native peoples. It will explore controversies concerning the impact of European penetration and

colonial policies on inter-tribal relations, cultural identity, and other aspects of native life.

- Anthropology 54.519F1 or W1

Development, Dependency and Gender

This course will examine varieties of "development" and "dependency" theories, and feminist critiques of both, in analyzing gender relations in the Third and Fourth Worlds. Emphasis will be on recent socialist feminist analyses which focus on the impact of a changing gendered division of labour in all aspects of life. Case studies from around the world will be examined to illustrate the impact of "development" on gender inequality and women's lives.

- Sociology 53.520F1 or W1

Comparative Social Systems

The seminar explores both perspectives and research procedures employed by sociologists in the systematic and explicit comparison of data from two or more societies. Major emphasis is placed on the theoretical and methodological issues in comparative research. Included among the topics for discussion are the nature of sociological propositions in comparative research, the problem of conceptual equivalence, research designs, and levels of analysis. Examples are drawn from both classical and contemporary comparative studies.

- Sociology 53.521F1 or W1

Comparative Methods in Social Research

A seminar dealing with current analytical problems and applications of comparative methods in social research. Students are expected to participate in a group research project in which one or more of these methods will be applied.

- Anthropology 54.522F1 or W1

The Anthropology of Underdevelopment

An anthropological analysis of theoretical and historically concrete issues in the study of variable economic systems ranging from domestic subsistence and peasant production to slavery and capital-dominated markets. Special attention is given to non-capitalist modes of production and social formations, theories of economic modernization, and anthropology's contribution to Marxian explanations of the causes and consequences of hinterland poverty and Third World underdevelopment. Debates over the relationship between the decision making, material provisioning, and cultural symbolling processes are also examined.

- Sociology 53.525T2

Canadian Society

A critical examination of sociological models of modern societies and their relevance to Canada.

Special attention is given to current research and its application to contemporary issues.

- Sociology 53.526F1 or W1

Sociology of Occupations and Professions

A consideration of the development of occupational recruitment patterns and manpower problems in developed and developing areas.

- Sociology 53.527F1 or W1

Sociology of Formal Organizations

A consideration of the forms and processes of bureaucracy in modern society, government and industry.

- Sociology 53.529F1 or W1

Sociology of Science and Technology

Study of the interaction among science, technology and change in modern societies.

- Sociology 53.530F1 or W1

Social Institutions I

Topic varies from year to year.

Students should check with the Department regarding the topic offered.

- Sociology 53.531F1 or W1

Social Institutions II

Topic varies from year to year.

Students should check with the Department regarding the topic offered.

- Sociology 53.532F1 or W1

The Labour Process

A consideration of the organization of work and production from feudal times to the present. The purpose of the course is to analyze the labour process in advanced capitalist societies by means of the historical comparative method.

- Sociology 53.533F1 or W1

Sociology of Education

The seminar generally concentrates on a specific topic within the larger field of the sociology of education. Among the topics considered will be the relations between education and other social institutions, the structure of educational opportunity, educational systems and organizations, and the sociology of learning.

- Sociology 53.536F1 or W1

Cultural Studies

The object of the seminar is to enhance our understanding of the relations between cultural practices and other social practices in definite social formations. Discussions are grounded through the choice of specific Canadian research on topics such as media, art, music, education, pedagogy, etc.

• Sociology 53.537F1 or W1
Psychoanalysis and Cultural Studies
This course will examine the relationship between psychoanalytic and sociological theory. A particular focus will be on the work of feminist theorists.

• Anthropology 54.538F1 or W1/
  Sociology 53.538F1 or W1
Feminist Analyses
This course surveys topics of current theory and research in recent feminist analysis. Both anthropological and sociological literature will be used.

• Sociology 53.539F1 or W1
Cultural Theory
A survey of developments in European and North American Marxist and Post-Marxist cultural theories of the past quarter century.

• Sociology 53.540F1 or W1
Political Sociology
An examination of theoretical and empirical work on selected aspects of the state, politics and political behaviour, primarily in North America and Europe.

• Anthropology 54.541F1
Proseminar in Anthropology I
This seminar provides an opportunity for students new to the graduate program to encounter anthropology as it is currently practised at Carleton University, with a special emphasis on the anthropology of signs and symbols, North American native studies, development and underdevelopment. Students will participate in faculty discussions of their own current research interests and opportunities for student research. The seminar puts the emphasis on the practice of anthropology and its political and ethical implications. Required of all students entering in fall term, during their first term of residence. Normally students entering at mid-year should register in this course during the first fall they are in residence.

• Anthropology 54.542W1
Proseminar in Anthropology II
This seminar will take up issues in the design and conduct of anthropological inquiry especially concerning the proposed thesis research of students currently enrolled, the analysis of ethnographic material and the development of explanatory frameworks, all against the background of theoretical debates prevailing in the discipline. It will give students undertaking thesis research an opportunity to discuss specific concerns in the conduct of their own thesis research and findings with faculty, students and invited discussants.
Prerequisite: Completion of 54.541F1 or permission of the Department.

• Anthropology 54.543F1 or W1
The Anthropology of Signs and Symbols
This course will examine various theoretical and methodological approaches to the anthropology of signs and symbols, their internal workings, and their relationship to other aspects of social life. These approaches may include structural and post-structural semiotics, psychoanalysis, feminism, critical anthropology, neuroanthropology, hermeneutics, and phenomenology. Discussions will be grounded through illustrative analyses of concrete case-studies and exemplary cases of possible interpretive strategies.

• Sociology 53.544F1 or W1
Race, Ethnicity and Class in Contemporary Societies
Various theoretical approaches concerning the persistence and re-emergence of ethnic and/or racial groups will be examined. Particular emphasis will be given to the intersection and overlap of ethnicity and race with social class.

• Sociology 53.545F1 or W1
Power and Stratification
An examination of theories of elite behaviour, social class, and ideology.

• Anthropology 54.548F1 or W1/
  Sociology 53.548F1 or W1
Feminism and Materialism
An examination of recent attempts to develop feminist materialist theory and analyses. Substantive areas may include: the gender division of labour; family and economy; gender and class; gender, race and ethnicity; sexuality; reproduction; theory and politics. Both the anthropological and sociological literature will be utilized.

• Sociology 53.549F1 or W1
The Politics of Social Movements and the State
This course investigates the origins, ideologies, strategies and political implications of social and popular movements in North America and Western Europe which have recently tested the legitimacy of advanced capitalist states and industrial systems. Attention is given to the peace, feminist, gay, ecology and anti-racist movements, as well as to the emergence of the New Right. Among the issues explored are the status of popular movements as vehicles for social change and state restructuring, the transformation of oppositional movements into alternative political parties, and the challenge posed by contemporary movements — both progressive and right wing, to western Marxism, left and liberal politics.

• Sociology 53.550F1 or W1
Gender Formation and State Formation
The course examines the role of states in the formation of gender relations, in the context of class and race, and the production of gender as an aspect of state formation. The various levels of the state are conceived as both a site and object of gender politics.

• Sociology 53.554F1, W1 or S1
Selected Problems in Political Economy I
A research seminar which will explore a selected topic from current research in political economy, such as: a) the sociology of the state; b) developments in the theory of culture and ideology; c) analysis of the sociology of the labour market; d) developments in socialist-feminist theory.
Topic varies from year to year.
Students should check with the Department regarding the topic offered.

• Sociology 53.555F1, W1 or S1
Selected Problems in Political Economy II
A research seminar which will explore a selected topic from current research in political economy, such as: a) the sociology of the state; b) developments in the theory of culture and ideology; c) analysis of the sociology of the labour market; d) developments in socialist-feminist theory.
Topic varies from year to year.
Students should check with the Department regarding the topic offered.

• Sociology 53.560F1 or W1
Critical Discourse Analysis
The discursive organization of power, domination and resistance form the main focus of this course. The relations between discourse, social semiotics, extradiscursive semiotics and social organization will be examined. The approach will draw on the contributions of diverse disciplines to theorizing topics relevant to the central topics being investigated.

• Sociology 53.565F1 or W1
Demographic Analysis
A seminar devoted to the intensive study of analytical strategies and techniques employed in demographic research. Attention is also given to mathematical and statistical models used in demography, which are relevant to research in other areas of sociology.

• Sociology 53.566F1 or W1
Selected Topics in Sociology
Topic varies from year to year.
Students should check with the Department regarding the topic offered.

• Sociology 53.567F1 or W1
Contemporary Theories of Crime and Social Regulation
The purpose of this course is to acquaint students with recent developments in theories of criminality and social regulation. Particular reference will be made to the regulatory mechanisms of both public and private spheres within legal institutions, corrections, economic institutions and the family.

• Sociology 53.568F1 or W1
Women and Work
This course examines various approaches and issues concerning women and work. Among the topics which may be considered are housework, occupational segregation in the paid labour force, part-time work, the changing economic structure of work, wage inequality, and state policies with respect to childcare, equal pay and work of equal value, and affirmative action.

• Sociology 53.577F1 or W1
Crime, Social Control and Social Change
An examination of the role of the discourses and ideologies surrounding crime, criminal processes and social change. Topics will vary from year to year and may include such issues as juvenile justice, victimization, corporate crime, criminalization of indigenous peoples, substance use and abuse.

• Sociology 53.582F1 or W1
Departmental Seminar
Topic varies from year to year.
Students should check with the Department regarding the topic offered.

• Sociology 53.583F1 or W1
Critical Theory
The seminar will focus on recent developments in critical theory based upon its initial formulation by the Frankfurt School, with emphasis upon particular contemporary theories in a given year, e.g. J. Habermas, H. Willems, etc.

• Sociology 53.584F1 or W1
Modern Marxist Theory
An examination of topics of theory and research in modern Marxist literature; the central focus is on problems of class analysis, the state, and politics in advanced capitalist societies.

• Sociology 53.585F1 or W1
Selected Topics in Sociology
Topic varies from year to year.
Students should check with the Department regarding the topic offered.

• Sociology 53.586F1 or W1
Selected Topics in Sociology
Topic varies from year to year.

Students should check with the Department regarding the topic offered.

• Anthropology 54.587F1 or W1
Selected Topics in the Anthropology of Signs and Symbols
Topic varies from year to year.
Students should check with the Department regarding the topic offered.

• Anthropology 54.588F1 or W1
Selected Topics in North American Native Studies
Topic varies from year to year.
Students should check with the Department regarding the topic offered.

• Sociology 53.589F1 or W1
The Logic of the Research Process
An examination of the research process, including the phases of conceptualization, choice of indicators, sampling, data collection, and analysis. Published articles will be studied as exemplars of the range of possible research strategies.

• Anthropology 54.589F1 or W1
Selected Topics in the Anthropology of Development and Underdevelopment
Topic varies from year to year.
Students should check with the Department regarding the topic offered.

• Sociology 53.590F1, W1, S1
Tutorial

• Anthropology 54.590F1, W1, S1
Tutorial

• Sociology 53.595F4, W4, S4
Course-Work Comprehensive in Sociology
Available for students in a course-work M.A. who by the third term in their M.A. program have not yet completed their written and oral examinations. Completion of this course does not reduce the formal requirement of five full courses.

• Anthropology 54.595F4, W4, S4
Course-Work Comprehensive in Anthropology
Available for students in a course-work M.A. who by the third term in their M.A. program have not yet completed their written and oral examinations. Completion of this course does not reduce the formal requirement of five full courses.

• Anthropology 54.596F1, W1, S1
Field Seminar
This course is concerned with the conduct of directed field research, by special arrangement (for individuals or groups), to be combined with readings and papers under the supervision of a faculty member. The course may normally be taken only once in a student's program.

• Anthropology 54.597F1, W1, S1
Field Placement in Anthropology
This course offers the student an opportunity to earn academic credit by engaging in research activities under the supervision of professional researchers in museums, government departments, nongovernmental organizations, or other professional research settings. Grades are assigned in consultation between research placement supervisors and the coordinator of the graduate program in anthropology. Placement research must be related to the preparation of the Master's thesis.

• Sociology 53.599F4, W4, S4
M.A. Thesis

• Anthropology 54.599F4, W4, S4
M.A. Thesis

• Sociology 53.600T2
Doctoral Seminar
An in-depth study of current research in sociology including an enquiry into research techniques, conceptualization and attendant theoretical issues. This course is required of all first-year doctoral students in sociology.

• Sociology 53.601F1 or W1
Selected Topics in Sociology
Topic varies from year to year.
Students should check with the Department regarding the topic offered.

• Sociology 53.690F1, W1, S1
Tutorial

• Sociology 53.699F, W, S
Ph.D. Thesis

Officers of the University

Chancellor

Arthur Kroeger, O.C., M.A. Oxford, LL.D. Western

President and Vice-Chancellor

R.H. Farquhar, B.A., M.A. British Columbia, Ph.D. Chicago, F.C.C.E.A.

Board of Governors

Chair
Maureen O'Neil, B.A.

Vice-Chair
Ivan Fellegi, O.C., Ph.D.

Ex-Officio Members
The Chancellor
The President and Vice-Chancellor

Elected Members

Retire June 30, 1994
A.J. Freiman, B.A.
William Joe
Robert Laughton, Q.C., B.A., LL.B.
Allen Lumsden, C.A., B.Com.
Terence Matthews
Peter Pivko, B.Arch.
Elaine Silver
Kate Thorne
Italo Tiezzi, B.A.
Ellizabeth Waddell, B.P.H.E.
James Watson, B.A.
Lucy Watson
Vladimir Zhivov, B.A.

Retire June 30, 1995
John ApSimon, B.Sc., Ph.D.
Ivan Fellegi, M.Sc., Ph.D
Christina Fiedorowicz, B.A., M.A., Ph.D.
Michel Gaulin, B.A., M.A., Ph.D.
S.F.Hughes
Wes Nicol, B.A.
Maureen O'Neil, B.A.
Mairuth Sarsfield, CQ, B.A., M.J.
Zeev Vered, B.Eng., P.Eng.

Retire June 30, 1996
G.S. Adam, B.J., M.A., Ph.D.
I.L. Craig, B.A.

Marion Dewar, R.N., B.ScN., Dip.P.H.N.
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Calendar of Milestones

The Institution

1942

The Ottawa Association for the Advancement of Learning was established to develop Carleton College. The College offered only evening classes in introductory university subjects, with some courses in public administration.

1943

The Ottawa Association for the Advancement of Learning was incorporated and the Institute for Public Administration was established..

1945

Beginning of day classes and full-time teaching in arts, science, journalism, and first-year engineering. Establishment of the Faculty of Arts and Science.

1946

Move from rented premises to First Avenue campus, formerly Ottawa Ladies' College. First degrees awarded in journalism and public administration.

1947

The College committed itself to develop pass and four-year honours programs.

1949

First undergraduate pass degrees in arts, science, and commerce awarded. Formation of Senate.

1950

First honours degrees in arts and science awarded.

1952

The Carleton College Act, 1952 passed by the Ontario Legislature. This changed the corporate name to Carleton College and confirmed the power to grant degrees. Property for Rideau River campus acquired.

1953

Establishment of the School of Public Administration.

1954

Appointment of Architectural Associates for Carleton to prepare a master plan for Rideau River campus, and to design the first group of buildings. First honorary degree (LL.D.) conferred on Dag Hammarskjöld, Secretary-General of the United Nations.

1955

First Master of Arts degree awarded.

1957

The Carleton University Act, 1957. Establishment of the School of Engineering. Establishment of the Institute of Canadian Studies.

1958

First Master of Science degree awarded.

1959

Move to Rideau River campus, following construction of the Henry Marshall Tory Building (science), the Maxwell MacOdrum Library, and Norman Paterson Hall (arts).

1961

First Ph.D. degree in science awarded. First degrees in engineering awarded.

1962

Southam Hall, the University Commons, Renfrew House and Lanark House (residences) completed. Norman Paterson Hall extended, and University Union opened.

1963

First Master of Engineering degree awarded. Reorganization into the Faculties of Arts, Engineering, Science, and Graduate Studies.

1964

The C.J. Mackenzie Building (engineering) completed.

1965

The E.W.R. Steacie Building (chemistry), Grenville House and Russell House (residences), Maintenance Building, and Heating Plant completed.

1966

First Ph.D. degree in engineering awarded. The Physics Building completed (designated in 1972 as the Herzberg Laboratories for Physics). Establishment of the Schools of International Affairs and Commerce.

1967

Loeb Building (social sciences) completed. Integration of St. Patrick's College as a division of the Faculty of Arts. Integration of the School of Social Work.

1968

First Ph.D. degree in arts awarded. First Master of Social Work degree awarded. Establishment of the School of Architecture.

1969
Controlled Environmental Facility (biology), Administration Building, Glengarry House (residence), and University Commons (residence cafeteria) completed.

1970
University Centre and Parking Garage completed.

1971
Arts Tower completed.

1972
Architecture Building completed. School of Social Work accommodated on the Rideau River campus.

1973
St. Patrick's College moves to new facility on the Rideau River campus. First degrees in architecture awarded. New athletic complex containing 50-metre pool and fitness centre opened. School of Industrial Design established.

1974
Faculty of Graduate Studies expanded into the Faculty of Graduate Studies and Research. School of International Affairs renamed the Norman Paterson School of International Affairs. Master of Journalism program approved for September 1974. Master of Arts programs in anthropology and in religion approved for September 1975. Program leading to Certificate in the Teaching of English as a Second Language established.

1975
Lester B. Pearson Chair for International Affairs approved for January 1, 1975. Establishment of Gerhard Herzberg Lecture Series in Science.

1976
First Dunton Alumni Award presented, January 1976. Creation of the Paterson Centre for International Programs in March 1976. Division of the Faculty of Arts into two separate faculties: the Faculty of Arts and the Faculty of Social Sciences, effective July 1976. First Master of Journalism degrees awarded, November 1976.

1977
Opening of the Criminology and Corrections concentration at St. Patrick's College, April 1977.

1978
School of Continuing Education established. Credit courses offered on cable television for the first time. Institute of Biochemistry established.

1979
St. Patrick's College ceased to operate as an academic unit of the University. Academic programs of the college continue as University programs, except for the Unified Liberal Arts Program.

1980
Establishment of the School of Computer Science. Establishment of the Chair of Office Automation in the Faculty of Engineering.

1981
Establishment of the Ottawa-Carleton Institute for Graduate Studies and Research in Chemistry, a joint program with the University of Ottawa. Establishment of a joint Ph.D. program in economics with the University of Ottawa.

1982
Establishment of the Ottawa-Carleton Centre for Geoscience Studies, representing the combined research strengths of Carleton University and the University of Ottawa, with programs leading to M.Sc. and Ph.D. degrees in most areas of geology. Establishment of a joint master's program in computer science with the University of Ottawa.

1983
Establishment of four joint graduate programs with the University of Ottawa: the Ottawa-Carleton Centre for Graduate Studies and Research in Biology; the Ottawa-Carleton Centre for Graduate Studies and Research in Physics; the Ottawa-Carleton Institute for Graduate Studies and Research in Electrical Engineering; and the Ottawa-Carleton Graduate Specialization in Neuroscience.

1984
Establishment of three joint graduate programs with the University of Ottawa in the areas of civil engineering, mechanical and aeronautical engineering, and mathematics and statistics.

1985
Master of Management Studies program established in the School of Business. The School of Public Administration offers a concentration in development administration in conjunction with the Norman Paterson School of International Affairs. An additional floor on one wing of the Herzberg Laboratories for Physics is constructed to house the School of Computer Science.

1986
The Social Sciences Research Building, the first new building on campus in a decade, is built to accommodate the rapidly-expanding research activity in the Faculty of Social Sciences. Construction of an annex on top of the Architecture Building to provide additional space for the Faculty of Engineering.

1987

The Institute of Women's Studies is established. The Arts Tower is renamed Davidson Dunton Tower/ Edifice Davidson Dunton in honour of Arnold Davidson Dunton, former Carleton University President and Director of the Institute of Canadian Studies. Major revisions to the Undergraduate Exchange Agreement with the University of Ottawa extend opportunities for students to study at both universities. The University launches the Carleton University Challenge Fund, the largest fund-raising campaign in its history.

1988

Canada's first full Bachelor of Engineering program in Aerospace Engineering is established. Bell–Northern Research Limited and the Natural Sciences and Engineering Research Council provide funding for an Industrial Research Chair in Computer-Aided Engineering within the Department of Electronics. The Departments of Electronics and Systems and Computer Engineering are major partners in the Telecommunications Research Institute of Ontario (TRIO), one of seven "centres of excellence" chosen by the provincial government for scientific research. The Faculty of Science introduces cooperative education programs in computer science and biochemistry/biotechnology.

1989

The University launches its first major program of construction and renovation in more than 20 years. Four capital projects are initiated: an addition to the MacOdrum Library; the Minto Centre for Advanced Studies in Engineering; a 400-bed residence building; and an addition to Southam Hall. A fifth project, the Life Sciences Research Building, is completed in 1989. The Institute of Political Economy is established. The Canadian Centre for Trade Policy and Law, a joint initiative of the Norman Paterson School of International Affairs at Carleton and the Faculty of Law at the University of Ottawa, is established.

1990

A new Ph.D. program in computer science, offered jointly with the University of Ottawa, is established. The University introduces a Bachelor of Social Work degree program. The Paul Menton Centre for Persons with Disabilities is opened. The Centre for Research in Particle Physics is established to carry on the work of the National Research Council's large-scale physics projects.

1991

Establishment of the Carleton University Development Corporation. $11 million extension to the MacOdrum Library opened. The university's $30 million Challenge Fund campaign surpassed its goal; $1.5 million "enhancement" campaign announced. Registrarial services for arts and social sciences re-organized into two separate offices. Establishment of the Centre for Analytical and Environmental Chemistry. Establishment of the School of Comparative Literary Studies. Establishment of the School for Studies in Art and Culture (bringing together the Departments of Art History, Film Studies, and Music). Establishment of the international exchange agreement between Carleton University, four Swedish universities, and three other Canadian universities (Laval, York, and the University of British Columbia). Establishment of the Carleton University/Polish faculty exchange agreement. Establishment of the Chair for Management in Technological Change. Establishment of M.A. programs in political economy, communication, legal studies, and applied language studies. Establishment of the women's history field in the Ph.D. program in history. Establishment of the Ph.D. program in public policy in the School of Public Administration.

1992

The University celebrates its 50th anniversary. Institute for Interdisciplinary Studies, which includes a new B.A. program in environmental studies, is established. Department of Civil Engineering renamed Department of Civil and Environmental Engineering to reflect emphasis on the environment and new undergraduate program in environmental engineering. School of Journalism renamed School of Journalism and Communication, and Institute of Canadian Studies becomes School of Canadian Studies. The Centre for Aboriginal Education, Research and Culture is established. A new Ph.D. program in public policy, the first of its kind in Canada, is offered by the School of Public Administration, and a master's program in Canadian art history is introduced. The Carleton University Art Gallery and the Minto Centre for Advanced Studies in Engineering are opened. The Governor General of Canada and Head of the Canadian Heraldic Authority, His Excellency the Right Honourable Ramon John Hnatyshyn, grants the arms and flag of Carleton University at the fall convocation ceremonies.

1993

Centre for Memory Assessment and Research established. Teaching and Learning Resource Centre established. Institute of Soviet and East European Studies renamed Institute for Central/East European and Russian Area Studies. Carleton University hosts the 1993 Learned Societies Conference. Construction begins on new Inco Centre. Institute of

Women's Studies renamed Pauline Jewett Institute of Women's Studies. Administration Building renamed Robertson Hall.

Chancellors

1952 - 1954
Harry Stevenson Southam
1954 - 1968
Chalmers Jack Mackenzie
1969 - 1972
Lester Bowles Pearson
1973 - 1979
Gerhard Herzberg
1980 - 1990
Gordon Robertson (Emeritus 1992 -)
1990 - 1992
Pauline Jewett
1993 -
Arthur Kroeger

Presidents

1942 - 1947
Henry Marshall Tory

1947 - 1955
Murdoch Maxwell MacOdrum

1955 - 1956
James Alexander Gibson (acting)

1956 - 1958
Claude Thomas Bissell

1958 - 1972
Arnold Davidson Dunton

1972 - 1978
Michael Kelway Oliver

January 1 - May 15, 1979
James Downey (pro tempore)

1979 - 1989
William Edwin Beckel

1989 -
Robin Hugh Farquhar

Public Lectures

Major Lecture Series

A distinguished series of lectures first grouped together in 1989 and supported by each of Carleton University's five faculties.

The Florence Bird Lecture
This annual lecture was established in 1987 to explore the experiences of women in Canada and abroad. It is named in honour of the Honourable Florence Bird, in recognition of her work for the CBC, CIDA, the Royal Commission on the Status of Women in Canada, and the Senate. The lecture is sponsored jointly by the Faculties of Arts and Social Sciences.

The Davidson Dunton Research Lecture
Established in 1983, the Davidson Dunton Research Lecture is presented by a Carleton University scholar who is active in research and has achieved international recognition. The lecture is in honour of former Carleton University President Arnold Davidson Dunton.

The Gerhard Herzberg Lecture
Established in 1975 by the Faculty of Science, this lecture honours Gerhard Herzberg, former Chancellor of Carleton University and recipient of the 1971 Nobel Prize for Chemistry. The purpose of the lecture is to emphasize the relationship between science and society and to address an aspect of science which has a pronounced impact on our daily lives.

The Marston LaFrance Research Fellowship Lecture
The fellowship was established in 1979 by the Faculty of Arts in memory of Marston LaFrance, former Professor of English and Dean of Arts at Carleton University. Each year, the recipient presents a seminar or public lecture on some aspect of the research conducted while on fellowship.

The C.J. Mackenzie Lecture
The C.J. Mackenzie Lecture is sponsored by the Dean of the Faculty of Engineering in memory of Chambers Jack Mackenzie, former Chancellor of Carleton University. The first lecture in the series was held during the 1986-87 academic year.

The John Porter Memorial Lecture
This annual lecture is sponsored by the Faculty of Social Sciences in memory of John Porter, former Vice-President (Academic) at Carleton University

and a distinguished sociologist. The series was established in 1982.

Special Lectures

Individual lectures sponsored by various academic departments of institutes.

The Munro Beattie Lecture
This lecture was established in 1985 in honour of Alexander Munro Beattie, the founder and first Chair of the Department of English, in recognition of his outstanding contribution to Carleton University in teaching, scholarship and administration. The series is sponsored by the Department of English.

The Dick and Ruth Bell Lecture
Established in 1988 in honour of the late Dick Bell and Ruth Bell. The lecture will be delivered annually by distinguished scholars in the field of political science or by distinguished persons serving or having served in the public life of Canada or one of its provinces. Supported through the Dick and Ruth Bell Fund.

The Edgar and Dorothy Davidson Lecture
The Edgar and Dorothy Davidson Lecture was established in 1983 and is sponsored by the Department of Religion. The lecture brings a prominent scholar in the area of Religious Studies and related areas to speak at Carleton.

The McMartin Memorial Lecture
The McMartin Memorial Lecture is presented in alternate years by the Department of Religion at Carleton University and the Faculty of Graduate Studies at the University of Ottawa. The series was established in 1969 and is funded by Mrs. J.P. Gilhooly of Ottawa in memory of her parents, Mr. and Mrs. John McMartin. The lectures involve themes which promote the importance of ethical, moral, and religious standards to education and living.

The Adam Mickiewicz Memorial Lecture
Established in 1969, the Adam Mickiewicz Memorial Lecture is presented each year by noted authorities in the area of Soviet and East European Studies. The series is sponsored by Carleton University's Institute of Central/East European and Russian-Area Studies and the Adam Mickiewicz Foundation of Canada to commemorate Poland's foremost poet, Adam Mickiewicz.

The H.H.J. Nesbitt Lecture

This annual lecture series was established in 1987 by the Faculty of Science in honour of H.H.J. Nesbitt, Carleton University's first Dean of Science. The lectures are presented by Carleton alumni who have earned international recognition as scientists. The topics are of general interest to the public as well as the scientific community.

The Pickering Lecture

Established in 1975, the Pickering lecture topics focus on problems of developmental and childhood psychology. The Pickering Lecture is sponsored by the Psychology Department.

The Technology, Society, Environment Studies Committee Lecture

Established in 1981 to sensitize the public to the impact of technology on society and the environment. The lecture is sponsored by the Technology, Society and Environment Studies Committee.

The Philip E. Uren Memorial Lecture

The Philip E. Uren Memorial Lecture is sponsored by the Dean of the Faculty of Social Sciences in memory of Philip Uren, former Director of the Institute of Soviet and East European Studies, the Normal Paterson School of International Affairs, and the Paterson Centre for International Programs at Carleton University. This annual lecture was established in 1982.

No. Building Name
22 Architecture Building
28 Colonel By Child Care Centre
21 Dunton Tower
16 Environmental Laboratories
18 Glengarry House
14 Grenville House
13 Herzberg Laboratories for Physics
6 Lanark House
25 Life Sciences Research Building
15 Loeb Building
10 Mackenzie Building
2 MacOdrum Library
11 Maintenance Building
27 Minto Centre
3 Paterson Hall
9 Physical Recreation Centre
5 Renfrew House
17 Robertson Hall
14 Russell House
24 Social Sciences Research Building
4 Southam Hall
23 St. Patrick's Building
12 Steacie Building
26 Stormont-Dundas House
1 Tory Building
7 University Centre
19 University Commons

DOW'S LAKE

LOT 6

ANNIVERSARY PARK

RIDEAU CANAL

COLONEL BY DRIVE

CAMPUS AVENUE

UNIVERSITY DRIVE

LOT 5

26
23
19
14 18
5
6

LOT 4

LOT 3

9
28

RAVEN ROAD

BRONSON AVENUE

10 27
22
11
7
16
GARAGE P9
17

LOT 2

ALUMNI PARK

21
1
12

STEACIE PARKING LOT

2
3 13

LIBRARY ROAD

4
15
25

LOT 1

24
LOT 8

UNIVERSITY DRIVE

RIDEAU RIVER

Visitor Parking Only in These Locations
Parking Garage (P9)
Parking Lot 1
Parking Lot 2
Parking Lot 5
Parking Lot 6
Parking Lot 8
Steacie Parking Lot

■ Bank
✳ Bookstore and Computer Store
Ⓔ Entrances to Campus
? Information Carleton
❖ Post Office

— Notes —

Carleton

UNIVERSITY

Faculty of Graduate Studies and Research
Ottawa, Canada